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The Mineral Industry of Pennsylvania in 1970

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COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
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BUREAU OF MINES MINERALS YEARBOOK

The Mineral Industry of Pennsylvania

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES DEPARTMENT OF THE INTERIOR • Rogers C. B. Morton, Secretary

BUREAU OF MINES • Elburt F. Osborn, Director

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The Mineral Industry of Pennsylvania

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Pennsylvania Bureau of Topographic and Geologic Survey under a cooperative agreement for collecting information on all minerals except fuels. The contribution of unpublished information by many individuals is gratefully appreciated.

By Franklin D. Cooper [1]

Pennsylvania mineral production in 1970 had a record ouput value of $1,096 million, a $119 million increase over that of 1969. Those minerals showing an increase in total value compared with that of 1969, in million dollars, were anthracite, 4.6; bituminous coal, 123.5; lime, 0.3; sand and gravel, 2.5; and stone, 2.5. Those minerals having decreased in total value, in million dollars, were cement (portland and masonry), 6.0; clays, 3.8; copper, 0.3; petroleum (crude), 1.6; natural gas, 0.4; zinc, 0.6; and all other minerals whose individual values cannot be disclosed, 1.4.

Compared with 1969, the average f.o.b. mine value of anthracite increased $1.21 per ton and bituminous coal advanced $1.40 per ton. Collectively, solid fuels production accounted for 67 percent of the total mineral production value in 1970 and was 23 percent greater than in 1969.

Leading producing counties, with primary commodities in parentheses, were Washington, Greene, Allegheny, Armstrong and Indiana (bituminous coal), Northampton (cement), and Schuylkill (anthracite). Counties reporting no mineral production were Cameron, Juniata, and Pike.

[1] Physical scientist, Division of Fossil Fuels.

Table 1.—Mineral production in Pennsylvania [1]

Mineral	1969		1970	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland—thousand 376-pound barrels	44,893	$126,941	40,909	$121,100
Masonry—thousand 280-pound barrels	3,085	8,504	2,804	8,324
Clays [2]—thousand short tons	2,727	19,637	2,665	15,845
Coal:				
Anthracite—do	10,473	100,770	9,729	105,341
Bituminous—do	78,631	461,579	80,491	585,057
Copper—short tons	3,382	3,215	2,539	2,930
Gem stones	NA	4	NA	4
Lime—thousand short tons	2,008	28,952	1,887	29,279
Mica, scrap—short tons	W	W	1,000	60
Natural gas—million cubic feet	79,134	21,841	76,841	21,439
Natural gas liquids:				
LP gases—thousand 42-gallon barrels	35	78	34	87
Natural gasoline and cycle products—do	22	61	19	50
Peat—thousand short tons	35	407	44	517
Petroleum (crude)—thousand 42-gallon barrels	4,448	20,086	4,093	18,500
Sand and gravel—thousand short tons	18,105	31,451	18,504	33,915
Stone—do	66,992	117,726	66,241	120,187
Zinc [3] (recoverable content of ores, etc.)—short tons	33,035	9,646	29,554	9,055
Value of items that cannot be disclosed:				
Clays (kaolin), cobalt, gold, iron ore, pyrites, sericite-schist, silver, and tripoli	XX	25,470	XX	24,053
Total	XX	976,368	XX	1,095,743
Total 1967 constant dollars	XX	921,984	XX	p 991,647

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by consumers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

[3] Recoverable zinc valued at the yearly price of prime western zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of the ore at the mine.

Table 2.—Value of mineral production in Pennsylvania, by counties [1] [2]

(Thousands)

County	1969	1970	Minerals produced in 1970 in order of value
Adams	W	W	Stone, lime, clays, sericite-schist.
Alleghany [3]	$34,646	$35,582	Coal, cement, clays, sand and gravel, stone.
Armstrong	42,098	W	Coal, clays, sand and gravel, stone.
Beaver	3,420	W	Sand and gravel, coal, clays.
Bedford	W	W	Stone, coal, lime, sand and gravel.
Berks	W	W	Iron ore, cement, stone, clays, coal, sand and gravel, pyrites, cobalt.
Blair	2,138	2,110	Stone.
Bradford	W	W	Sand and gravel.
Bucks	12,376	W	Stone, sand and gravel, clays.
Butler	[4] 12,694	W	Coal, stone, cement, lime, sand and gravel.
Cambria	W	W	Coal, clays, stone.
Carbon	5,450	5,318	Coal, sand and gravel, stone.
Centre	21,808	23,581	Lime, coal, stone, clays.
Chester	W	W	Stone, lime, clays.
Clarion	17,143	22,723	Coal, stone, sand and gravel, clays.
Clearfield	27,564	34,372	Coal, clays.
Clinton	W	W	Coal, stone, clays.
Columbia	3,982	W	Coal, stone, sand and gravel, peat.
Crawford	537	740	Sand and gravel.
Cumberland	3,021	W	Stone, sand and gravel, clays.
Dauphin	3,253	W	Stone, coal, sand and gravel, clays.
Delaware	W	W	Stone.
Elk	W	W	Coal, stone.
Erie	W	W	Sand and gravel, peat.
Fayette	7,578	17,482	Coal, stone, clays.
Forest	461	W	Sand and gravel.
Franklin	1,581	W	Stone, sand and gravel.
Fulton	W	W	Do.
Greene	89,913	102,235	Coal.
Huntingdon	W	W	Sand and gravel, stone, clays.
Indiana	W	60,525	Coal.
Jefferson	W	W	Coal, clays, stone.
Lackawanna	W	W	Coal, peat, sand and gravel.
Lancaster	10,794	10,499	Stone, coal, clays, sand and gravel.
Lawrence	W	W	Cement, coal, stone, sand and gravel, clays, peat.
Lebanon	23,850	W	Iron ore, lime, copper, stone, cobalt, pyrites, gold, silver.
Lehigh	34,654	32,842	Cement, zinc, stone.
Luzerne	37,769	35,212	Coal, sand and gravel, stone, peat, clays.
Lycoming	W	W	Stone, sand and gravel, coal, tripoli.
McKean	217	W	Clays, stone.
Mercer	2,166	W	Coal, sand and gravel, stone.
Mifflin	W	W	Sand and gravel, stone, lime.
Monroe	869	W	Stone, sand and gravel, clays, peat.
Montgomery	W	W	Stone, cement, lime, clays.
Montour	W	W	Stone, lime.
Northampton	60,824	63,992	Cement, stone, sand and gravel.
Northumberland	W	W	Coal, clays, stone.
Perry	W	W	Stone.
Philadelphia	----------	W	Sand and gravel.
Potter	107	93	Stone.
Schuylkill	41,241	W	Coal, stone, sand and gravel, clays.
Snyder	398	W	Sand and gravel, stone, coal.
Somerset	23,911	27,348	Coal, stone, clays.
Sullivan	160	964	Coal.
Susquehanna	W	606	Stone.
Tioga	W	W	Coal, sand and gravel.
Union	W	W	Stone, clays.
Venango	W	W	Coal, sand and gravel, stone.
Warren	696	933	Sand and gravel.
Washington	W	W	Coal, stone, clays.
Wayne	632	W	Stone, sand and gravel, peat.
Westmoreland	W	24,375	Coal, sand and gravel, stone.
Wyoming	1,322	W	Sand and gravel.
York	[4] 10,226	W	Cement, stone, lime, clays, sand and gravel, mica.
Undistributed	436,868	594,213	
Total [5]	976,368	1,095,743	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Cameron, Juniata, and Pike Counties are not listed because no production was reported.

[2] Values of natural gas, natural gasoline, LP gases, petroleum, gem stones, sand and gravel, and stone unspecified by counties; included with "Undistributed."

[3] Excludes cement, included with "Undistributed."

[4] Excludes cement and lime; included with "Undistributed."

[5] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Pennsylvania business activity

		1969	1970	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	5,013.2	5,043.5	+0.6
Unemployment	percent of work force	2.9	4.0	+37.9
Employment:				
Manufacturing	thousands	1,580.9	1,525.6	−3.5
Durable goods	do.	940.2	902.4	−4.0
Lumber and wood products	do.	14.5	14.0	−3.4
Furniture and fixtures	do.	29.8	27.8	−6.7
Stone, clay, and glass products	do.	66.7	64.1	−3.9
Primary metals	do.	253.0	244.2	−3.5
Fabricated metal products	do.	116.3	112.8	−3.0
Nonelectrical machinery	do.	141.7	138.0	−2.6
Electrical equipment	do.	160.9	152.4	−5.3
Transportation equipment	do.	77.9	72.7	−6.7
Instruments	do.	38.7	37.9	−2.1
Nondurable goods	do.	640.6	623.3	−2.7
Food products	do.	114.6	114.0	−.5
Apparel and related products	do.	182.4	171.5	−6.0
Paper products	do.	48.7	48.7	----------
Printing	do.	69.5	70.1	+.9
Chemical products	do.	63.0	62.1	−1.4
Nonmanufacturing	do.	2,788.8	2,823.5	+1.2
Mining	do.	38.9	39.6	+1.8
Contract construction	do.	203.1	195.6	−3.7
Personal income:				
Total	millions	$43,182	$45,962	+6.4
Per capita		$3,678	$3,893	+5.8
Construction activity:				
Value of authorized nonresidential construction	millions	$514.0	$285.4	−44.5
Number of new residential units authorized		44,039	41,622	−5.5
Cement shipments to and within Pennsylvania	thousand 376-pound barrels	19,901	17,259	−13.3
Mineral production	millions	$976.4	$1,095.7	+12.2

Sources: Pennsylvania Department of Labor and Industry, Bureau of Employment Security and Statistics; Survey of Current Business; Construction Review; U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Frequency	Severity
1969:								
Bituminous coal	21,139	245	5,169	41,424	26	1,073	26.53	5,690
Anthracite	5,927	232	1,377	10,073	13	492	50.14	9,090
Metal	1,383	303	419	3,348	1	29	8.96	2,044
Nonmetal	1,344	254	342	2,772	1	73	26.69	4,935
Sand and gravel	1,127	250	282	2,426	------	55	22.67	739
Stone	8,470	278	2,354	18,709	2	296	15.93	1,705
Peat	56	232	13	106	------	1	9.43	160
Total [1]	39,446	252	9,955	78,858	43	2,019	26.15	4,837
1970: [p]								
Bituminous coal	22,000	250	5,507	44,143	31	1,170	27.16	5,854
Anthracite	6,000	240	1,447	10,533	5	485	46.71	4,123
Metal	1,350	303	409	3,273	1	20	6.42	2,172
Nonmetal	1,100	252	278	2,240	------	82	36.61	1,997
Sand and gravel	1,125	240	270	2,360	2	84	36.45	8,443
Stone	7,900	276	2,177	18,079	5	267	15.04	2,714
Peat	55	231	13	90	------	4	44.34	3,303
Total [1]	39,580	255	10,100	80,717	44	2,112	26.71	4,741

[p] Preliminary.
[1] Data may not add to totals shown because of independent rounding.

Environment.—The abatement of environmental problems, many of which involved the mineral industry directly, was prominent in 1970 Pennsylvania news. The State's implementation of many noteworthy projects was facilitated by funding from a portion of the $500 million bond issue for conservation made available by popular vote in the May 1966 primary election.

Air Pollution.—The National Air Pollu-

tion Control Administration (NAPCA) awarded the Consolidation Coal Co. a $280,916 contract to obtain, in the company's laboratories at Library, basic information needed to demonstrate a new process for producing electricity from high-sulfur steam coal without polluting the atmosphere. This experimental program, being of particular interest to new power stations using both gas and steam turbines, will use the carbon dioxide-acceptor concept previously developed by the company in a coal-gasification project sponsored by the Office of Coal Research.

The construction of a small experimental plant in Pittsburgh to produce solid sulfur from coal was provided for by a $892,561 contract between NAPCA and Black, Sivals, & Bryson, Inc. Pulverized coal burned in a combustor containing molten iron will produce solid sulfur as a byproduct rather than sulfur dioxide.

The Allegheny Power System was one of six U.S. and Canadian utilities that agreed to underwrite a $1.6 million test of the

Figure 1.—Value of bituminous coal, anthracite, cement, and total value of mineral production in Pennsylvania.

Consolidation Coal Co.'s formate process for the removal of sulfur dioxide from stack gases. The first part of the project, the construction and operation of a small pilot unit at Library, will require 18 to 20 months to complete. The second part will require the installation of a semi-works scrubber at the Phoenixville Station of the Philadelphia Electric Co. to test the scrubbing part of the circuit.

Universal Atlas Cement Division at Northampton replaced electrostatic precipitators installed in 1948 with a $2 million dust-collector system comprising two baghouses, each containing 936 glass bags, capable of cleaning 150,000 cubic feet per minute of effluent gases up to 550° F. The Whitehall Cement Mfg. Co. contracted for the installation of a $500,000 baghouse-dust collection system at its Cementon plant to augment similar equipment installed in 1966 on the larger of two kilns.

The Allegheny County Health Department, Bureau of Air Pollution Control, used an IBM-1800 computer as the key element in the Pittsburgh area's air-pollution monitoring system. The on-line device gathered 18 parameters of data from three stations in the county. Eventually, a total of 17 stations will be linked with the computer.

A new $2.4 million stack-gas cleaning system was put into operation at the Bethlehem sintering plant of the Bethlehem Steel Corp. Each of two electrostatic precipitators in the system can clean up to 290,000 cubic feet per minute of effluent gases from two of the four sinter machines in the plant.

The United States Steel Corp. at its Clairton Works installed a cyclone dust collector on a pelleted-pitch drying unit and also experimentally operated a continous coke-quenching facility which reportedly removed as much as 85 percent of the particulates and most of the water droplets discharged to the atmosphere from a quenching tower. A third baghouse was installed at the Saxonburg sintering plant of the Homestead Works. The boiler house of the Ellwood plant of the Gary-Ellwood Works was converted from coal to natural gas. The corporation installed electrostatic precipitators rated at 720,000 standard cubic feet per minute in the open-hearth shops at the Fairless Works.

The Alan Wood Steel Co. at Conshohocken completed the installation of separate collection systems for flux dust and kish in its basic oxygen furnace shop.

Air and water pollution abatement programs were completed at Brackenridge by the Allegheny Ludlum Steel Division. Similiar projects were in progress at Washington by the Jessop Steel Co., at Coatesville by the Lukens Steel Co., and at Allenport and Monessen by the Wheeling-Pittsburgh Steel Corp.

Local sulfur oxide control regulations limited the sulfur content of fuels during 1970. In Allegheny County, bituminous coal was limited to 1.7 percent and oil to 2.3 precent, both effective December 17, 1969. In Philadelphia County, bituminous coal was limited to 2.0 percent, anthracite to 0.7 percent, No. 2 oil to 0.3 percent, No. 4 oil to 0.7 percent, and No. 5 and No. 6 oils to 1.0 percent, all effective May 1, 1970.

In May, the Grays Ferry Slag Corp. at Swedeland installed a second pelletizer that eliminated the emission of yellow smoke and hydrogen sulfide during the conversion of molten blast furnace slag into aggregates.

Section 12 of the Air Pollution Control Act of Jan. 8, 1960, Public Law 2119, as amended through 1968, section 4,001 et seq., provided for powers reserved to a political subdivision having an approved air-pollution control agency. Allegheny and Philadelphia Counties had such agencies in 1970, but the State's other 65 counties were regulated by the former Air Pollution Commission prior to Jan. 19, 1971. Air pollution abatement installations either completed in 1970 or planned to be completed in the 1970–71 period in compliance with requirements of the three regulating agencies are listed in table 5.

Water Pollution.—Because nearly 3,000 of the State's 50,000 miles of streams and rivers have been polluted by the uncontrolled flow of acid water from abandoned solid fuels mines, a portion of a massive State program, known as Operation Scarlift, which is funded with $200 million for a 10-year period, was directed to control or abate water pollution.

The Federal Water Pollution Control Administration (FWPCA) provided research grants and contracts totaling over $2 million for studies of ways to prevent and control pollution. The Hi-Hills Ranch, Inc., of Waynesburg received some of these funds for a project to demonstrate

Table 5.—Air pollution abatement installations in 1970

Industry and county	Number of process compliances	Emission reduction,[1 2] tons per year	Estimated cost of equipment and controls	
			Thousands	Dollar per-ton-emission reduction per year
Ferrous metals:				
Allegheny [3]	10	2,400	$5,300	$2,208
Philadelphia [4]	5	[5] 1,773	360	203
All other [3]	8	25,801	10,805	419
Subtotal	23	29,974	16,465	553
Non-ferrous metals:				
Allegheny [3]	1	3,300	1,060	321
Philadelphia [4]	3	[6] 728	1,100	1,511
All other [3]	1	700	80	114
Subtotal	5	4,728	2,240	474
Nonmetallic minerals: [7]				
Allegheny [3]	8	100	400	4,000
Philadelphia [4]	2	[8] 350	225	643
All other [3]	7	12,960	965	75
Subtotal	17	13,410	1,590	118
Coal and petroleum:				
Allegheny [3]	NA	NA	NA	NA
Philadelphia [4]	3	[9] 2,119	5,190	2,448
All other [3]	[10] 8	47,760	3,855	81
Subtotal	11	49,879	9,045	181
Total:				
Allegheny [3]	19	5,800	6,760	1,161
Philadelphia [4]	13	4,970	6,875	1,383
All other [3]	24	87,221	15,705	180
State, all counties	56	97,991	29,340	299

NA Not available.
[1] Rated design capacity for pollutants including particulates, hydrocarbons and carbon monoxide.
[2] Based on specific but varied numbers of operating days per year.
[3] Installed in calendar year 1970; types of emissions not available.
[4] Actual and planned to be completed in the 1970–71 period.
[5] Comprises 1,143 tons particulates and 630 tons carbon monoxide.
[6] Comprises 464 tons particulates and 264 tons carbon monoxide.
[7] Rock products, plantmix asphalt, and other nonmetals but excluding fuels.
[8] Particulates only.
[9] Comprises 586 tons particulates and 1,533 tons petroleum hydrocarbons.
[10] Does not include numerous small fuel conversions rated at 2,000-tons-per-year emission reduction and costing an estimated $6 million.

whether sludge from an acid-mine-drainage neutralization plant could be dispersed into surface soil without polluting streams and groundwater. A $1 million laboratory, sponsored by the FWPCA and the State, was dedicated at Hollywood in October. The laboratory will be used for a long-term study of bacterial oxidation in relation to the neutralization of acid mine water.

The Office of Saline Water (OSW) signed a 2-year agreement with the State to study the potential of desalting processes to treat acid mine drainage thereby providing supplemental supplies of fresh water for municipal and industrial users.

The Pennsylvania Department of Mines and Mineral Industries (PDMMI) was studying many watersheds in the State to locate major sources of pollution before deciding on the most feasible elimination action.

The PDMMI and the Westinghouse Electric Corp., following 5 years of research, broke ground near the Susquehanna River at Wilkes-Barre for a $14.2 million mine-water demineralization plant. The plant, scheduled for completion in mid-1972, will employ flash distillation to produce 5 million gallons per day of ultrapure water suitable for fine chemical or textile manufacture.

An $800,000 treatment plant, designed to convert 500,000 gallons per day of brackish

(high sulfate) mine water into potable water suitable for residential or industrial uses was ready for shakedown operation at yearend near Burgettstown, Washington County. This first-of-its-kind municipal water plant was designed to use the SulbiSul ion-exchange process developed by The Dow Chemical Co. In this process calcium hydroxide can be used as a regenerant instead of sodium hydroxide.

The PDMMI started work on a $1,589,000 mine-drainage treatment plant near Valley View in Schuylkill County. This plant, the first of its kind in the anthracite-producing regions, was designed to process and neutralize 10 million gallons per day of acid mine water.

An $800,000 plant built by the State for the lime treatment of mine water was dedicated at Slippery Rock in Butler County. The resultant iron precipitates after thickening were stored in an abandoned strip mine.

The Swindell-Dressler Co. signed a $1.9 million contract with the PDMMI to build a mine-water treatment plant near Philipsburg in Clearfield County, to provide an additional 500,000 gallons per day of potable water to the area.

A number of industrial plants in the State installed water pollution control facilities during the year. Armco Steel Corp. completed spent-solution neutralization facilities at its steel pickling operations in Butler. Construction was in progress on two settling basins to trap mill scale and oil at the Homestead Works of the United States Steel Corp.

A retention dam and holding basin were completed to recover oil from effluent water at Sun Oil Co.'s Marcus Hook refinery complex. This construction was phase one of a $7 million to $8 million water-quality control program.

The Commonwealth's coal industry set the pace for the country with about 200 industry-operated mine-water treatment plants. These plants, in full operation at yearend, used lime for neutralization.

A unique project based on the injection of an inert gas was being studied in one mine in Pennsylvania and in another in West Virginia. The premise offered was that, if oxygen was displaced from a mine atmosphere, pyrite and marcasite would not be converted into soluble forms and mine drainage pollution programs would be reduced or eliminated.

Solid Wastes.—After compaction at a central location in Pittsburgh, 600 tons per day of solid wastes were trucked to a coal strip pit where the waste was covered with backfill. This landfill operation turned reclamation and waste disposal problems into an asset by producing an industrial or recreation area.[2]

In June 1970, the Duquesne Light Co., from its Cheswick generating station near Pittsburgh, started pumping 750 tons per day of fly ash and bottom ash slurried in 3 million gallons of water through three, 130-foot-deep, 24-inch bore holes into its abandoned Harwick mine near Springdale. Normal mine drainage and water from the settled slurry recovered from the mine was treated, starting in February 1971, in a $300,000 5-million-gallons-per-day plant using lime slurry, aeration, and a mechanical clarifier before discharging the water into Little Deer Creek. Sludge from the clarifier was pumped back into the mine.

About 100 tons of crushed and burned-out anthracite mine refuse was used as aggregate in repaving a haul road as part of a test by the State's Highway Dept. An estimated 50,000 tons of burned-out bituminous mine refuse was used for berm maintenance and ice control in 1970.

A $589,000 contract was awarded to Glasgow Inc. by Montgomery County to prepare a depleted 125-foot-deep limestone quarry at Merion Station for use as a sanitary landfill. The contract called for sealing the quarry to prevent the leakage of toxic fluids. Reportedly, the quarry can accept 400 tons per day of trash for a 5-year period.

The Reading Railroad Company was reported as having dumped and covered solid industrial wastes in a landfill enterprise in Delano Township, Schuylkill County.

Pursuant to provisions of the Coal Land Improvement Act of 1965 that was initially supported by a $1 million revolving fund, the State, as part of the Operation Scarlift program of the 1968–70 period, purchased 605 acres in privately-owned abandoned strip mined lands for reclamation and pol-

[2] Sheffer, H. W., E. C. Baker, and G. C. Evans. Case Studies of Municipal Waste Disposal Systems. BuMines Inf. Circ. 8498, 1971, 36 pp.

lution abatement purposes. Land agreements to attain the necessary access roads totaled 535. An amendment to the Act provided for the sale of such lands, after improvement by the State, to the highest bidders at no less than the cost of acquisition and restoration with the proceeds returned to the Land Acquisition Fund.

The Second Ash Utilization Symposium was held in Pittsburgh in March 1970. The symposium, which was jointly sponsored by the Bureau of Mines, the National Coal Association, the American Public Power Association, Inc., the Edison Electric Institute, and the National Ash Association, Inc., dealt with the problems and uses of ash from power-generating plants.[3]

Seven of the State's largest coal-burning electric utilities produced 3.2 million tons of fly ash and 1.6 million tons of slag and bottom ash, according to the National Ash Association.

Legislation and Government Programs.—Major conservation legislation dealing with the mineral industries was passed during the 1969–70 session of the General Assembly in 1970.

Act 38, an amendment to the Gas Operations Well-Drilling Petroleum and Coal Mining Act, declared a public policy for regulating additional gas storage pools; required the periodic inspection of all underground gas storage sites within the State by State personnel; and required the operators of all gas storages to furnish complete data to the Oil and Gas Division of the Department of Mines and Mineral Industries.

Act 50 authorized the acquisition either amicably or by condemnation of certain lands affected by open pit or strip mines and provided for the reclamation, use, and disposal of such lands.

Act 57 granted the Secretary of Mines and Mineral Industries the right to enter and restore abandoned strip mine areas and provided for liens upon such lands.

Act 187 amended the "Pennsylvania Solid Waste Management Act" by specifically providing for the regulation of disposal and transportation of solid wastes in mines.

Act 222 amended the Clean Streams Law by further regulating the discharge of sewage and industrial waste and the operation of coal mines and coal preparation plants, and imposed certain powers on the Sanitary Water Board, the Department of Health, and the Department of Mines and Mineral Industries. Regulatory powers were extended over all potential and actual sources of water pollution under provisions previously relating only to coal mining. This Act, by defining sediments as pollutants, provided for the regulation by permit of all impoundments exceeding 250,000 gallons. The Act also required that waters discharged into a receiving stream be within a pH range of 6 to 9, that they contain no acid, and no more than 7 parts per million of iron content.

Act 225 authorized a 10-cent-per-ton royalty on sand and gravel in or beneath certain rivers, streams, or other bodies of water.

Act 275, passed November 19, abolished the Department of Forests and Waters, the Sanitary Water Board, the Air Pollution Control Commission, and the State Soil and Water Conservation Commission. The Act created the Department of Environmental Protection and defined its functions, powers, and duties; transferred certain boards and commissions to the department; and repealed inconsistent acts.

H/B 1297 and H/B 1320, respectively, further regulated planting on the surfaces of spoil banks and backfills at bituminous and anthracite strip mines.

The Bureau of Mines awarded a $95,245 research grant to Pennsylvania State University to investigate safer and more efficient electrical systems for underground coal mines.

The Philadelphia Interstate Air Quality Control Region's standards adopted by Pennsylvania, Delaware, and New Jersey were the first to be approved by the Secretary of Health, Education, and Welfare (HEW) under the Air Quality Act of 1967. According to HEW spokesmen, the air quality in the Pennsylvania portion of the region would be improved because of a 70-percent reduction in sulfur oxides and a 56-percent reduction in particulate matter.

[3] Faber, John H., Neil H. Coates, and John D. Spencer. Ash Utilization: Proceedings Second Ash Utilization Symposium. BuMines Inf. Circ. 8488, 1970, 351 pp.

A Federal-State cooperative project was approved by the Department of the Interior for the installation of instrumented stations to monitor the level and acidity of water in abandoned anthracite mines. This project will provide a factual basis for future efforts to abate pollution in the watersheds of the Susquehanna and Schuylkill rivers, to prevent surface subsidence, and to eliminate flooding of low-lying urban areas.

Personnel from the FWPCA were assigned to the Pennsylvania Bureau of Sanitary Engineering for 2 days per month to promote a greater exchange of ideas and data to give more impetus and precision to control activities.

The Department of the Interior approved a Federal-State cooperative project to control a fire in the abandoned Larimer bituminous coal mine near Irwin in Westmoreland County. Under terms of the Appalachian Regional Development Act of 1965, the Federal Government will pay 75 percent of the project's cost.

The Southwestern Pennsylvania region, comprised of six counties centering on Pittsburgh, was designated by the Department of the Interior as one of six metropolitan areas in the United States for a comprehensive study of environmental and resource factors affecting growth and redevelopment. The detailed work of the $2 million, 4-year project will be conducted jointly by staff members of the U.S. Geological Survey and the Pennsylvania Department of Environmental Resources. Federal funds will cover 85 percent of the cost of the project that will study landslides on unstable slopes, subsidence related to mined-out areas, water pollution by industrial waste and acid water, flash floods, and limited construction resources.

The total costs of projects underway or authorized for the Interstate highway system in 1970 totaled $780.1 million, $101.3 million more than in 1969, while projects for primary, secondary, and urban highway extensions totaled $402.1 million, $8.4 million less than in 1969. The total cost of Interstate highway projects completed during the year was $129.3 million, while the total cost of primary, secondary, and urban highway extensions completed was $76.2 million. Interstate highway mileage opened to traffic since July 1, 1956, increased 108.66 miles to 1361.33 miles; at yearend 92.45 miles were under construction and 79.98 miles were in the design stage.[4]

During calendar year 1970, the Pennsylvania Department of Transportation awarded contracts for highway construction in the amount of $355.9 million. Expenditures in 1970 for highway construction in million dollars totaled 417.0 and was distributed as follows: Interstate, 97.3; primary, 42.0; secondary, 36.2; urban, 33.3; Appalachian, 22.8; and 100 percent State, 185.4. The total expenditures for highway construction were $3.9 million more than in 1969. In 1970 the total cost of maintenance work and snow and ice removal, all performed by State forces, was $147.3 million or $11.2 million more than in 1969.

The State's toll-free 313-mile portion of Interstate 80 was unofficially opened to traffic August 26 when the final sections in three counties were completed. The total project, built over a 12-year period, cost an estimated $424.3 million.

Pursuant to the Appalachian Regional Development Act of 1965, as amended, environmental activities completed or in progress during 1970 and their final cost or estimated value of contracts in force included 10 mine-fire control projects, three of which were completed in three counties at a cost of $4,432,000. Seven other such projects costing $6,586,000 were in progress in four counties. Additionally, one well-sealing project costing $160,000 was in progress, one subsidence control project costing $1,316,000 was completed, and another subsidence control project estimated at $1,480,000 was in progress. All of these projects had 75 percent Federal funding and 25 percent State funding. Another project, under Public Law 87–818 and funded equally by the Federal and State Governments, included the completion of backfilling of one hazardous anthracite mine opening at a cost of $21,000. Work similarly financed was in progress under Public Law 162 on mine-water monitoring stations, all in the anthracite region, at a total cost of $750,000. No surface mine reclamation projects were completed or in progress.

[4] Federal Highway Administration. Quarterly Reports on the Federal-Aid Highway Program. Dec. 31, 1969 and Dec. 31, 1970. Press Release FHWA–422, Feb. 10, 1970; Press Release FHWA–563, Feb. 17, 1971.

Eight Bureau of Mines publications released in 1970 discuss problems relating to the mineral industry of Pennsylvania.[5]

The Pennsylvania Geological Survey[6] and the U.S. Geological Survey also released relevant material.[7]

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Anthracite).—The production of 9,729,000 short tons was the smallest in 8 consecutive years and was less than 10 percent of the production in 1917, the record year. The $105.3 million total value was 4.5 percent more than in 1969 because of a $1.21-per-ton increase in average f.o.b. mine value, to $10.83.

Commercial exports, principally to Canada and Western Europe, totaled 789,499 tons, 161,318 tons more than in 1969, and were valued at $11.2 million. Exports of anthracite through Philadelphia totaled 558,458 tons. The Federal Government continued purchasing anthracite to supply most of the solid-fuel needs of the U.S. Armed Forces in West Germany. Such shipments in 1970 totaled 692,060 tons compared with 992,647 tons in 1969.

Domestic consumption in tons by U.S. consumer categories follows: 4,042,000, residential and commercial heating; 1,357,000, miscellaneous industrial uses; 1,897,000, electric utilities; 472,000, coke plants; 464,000 sintering and pelletizing; and 16,000 colliery fuel.

Production came from 209 underground mines, 179 strip pits, 97 culm banks, and five dredges. The sources and tonnages comprising the total production included underground mines, 1,742,000; strip pits, 4,542,000; culm banks and silt basins, 3,036,000; and river bottoms, 409,000. The major producing countries, accounting for 81 percent of the total State production, were Schuylkill, Luzerne, and Northumberland.

The salable production, except that produced by dredging, totaled 9,320,000 tons and came from 72 breakers, 16 washeries, and 12 cleaning plants employing 1,655 persons. Nearly all of the washing and cleaning operations used dense-medium vessels or cyclones, or Wemco-type cones. The average f.o.b. mine value of this production was $11.03 a ton.

Solids dredged from river bottoms, after processing by launder screens, yielded 409,000 tons of small sized fuel having an average value of $6.09 per ton.

Shipments and average values of the total salable production included 3,926,000 tons shipped by railroads at $10.47 per ton and 5,787,000 tons shipped by truck at $11.06 per ton. The remainder, 16,000 tons at $12.19 per ton, was used as colliery fuel.

Underground mines produced 17.9 percent of the State's total production. The 1970 underground production was 17.3 percent less than that in 1969. Output from the one large mine that remained in operation accounted for about 32 percent of

[5] Andreuzzi, Frank C. A Method for Extinguishing and Removing Burning Coal Refuse Banks. BuMines Inf. Circ. 8485, 1970, 29 pp.

Baker, E. C. Estimated Costs of Steel Slag Disposal. BuMines Inf. Circ. 8440, 1970, 18 pp.

Gait, G. B. Microfilming Maps of Abandoned Anthracite Mines. Mines in the Lackawanna Basin, Northern Anthracite Field. BuMines Inf. Circ. 8453, March 1970, 11 pp.

Glover, T. O., M. E. Hinkle, and H. L. Riley. Unit Train Transportation of Coal, Technology and Description of Nine Representative Operations. BuMines Inf. Circ. 8444, 1970, 109 pp.

Irani, M. C., and J. W. Hartwell. Mineral Materials for Chemical Industry in the Ohio River Basin of Ohio, Pennsylvania, and West Virginia. BuMines Inf. Circ. 8457, 1970, 86 pp.

McNay, Lewis M. Surface Mine Reclamation, Moraine State Park, Pennsylvania. BuMines Inf. Circ. 8456, 1970, 28 pp.

Rough, R. L., and W. K. Overbey, Jr. Lithologic Descriptions of Appalachian Area Oil-Producing Formations. BuMines Inf. Circ. 8473, June 1970, 133 pp.

Zeilinger, J. E., and A. W. Duerbrouck. Preparation Characteristics of Pennsylvania Anthracite From the Kidney Seam, Northern Field. BuMines Rept. of Inv. 7364, 1970, 19 pp.

[6] Kelley, D. R. and others. The Petroleum Industry and the Future Petroleum Province in Pennsylvania. Pa. Geol. Survey Pub. M65, 1970, 39 pp.

Lytle, W. S., and J. H. Goth. Oil and Gas Geology of the Kinzua Quadrangle. Pa. Geol. Survey Bull. M62, 1970, 99 pp.

Pennsylvania Geological Survey. Oil and Gas Developments in Pennsylvania in 1969 With Ten-Year Review and Forecast. Prog. Rept. 181, 1970, 65 pp.

Rose, A. W. Metal Mines and Occurrences in Pennsylvania. Pa. Geol. Survey Pub. M50, pt. 3, 1970, 14 pp.

Store, G. W., and A. I. Jonas. Geology and Mineral Resources of York County. Pa. Geol. Survey Pub. C67, (2nd printing), 1970, 195 pp.

[7] Cameron, C. C. Peat Deposits of Northeastern Pennsylvania. U.S. Geo. Survey Bull. 1317–A, 1970, pp A–1 to A–90.

Kent, B. H. Geologic Map of Part of the Carmichael Quadrangle, Southwestern Pennsylvania. U.S. Geol. Survey I–588, 1969–70, 1 p.

Kent, B. H. Geologic Map of the Mather Quadrangle, Southwestern Pennsylvania. U.S. Geol. Survey GQ–826, 1969–70, 1 p.

Roen, J. B. Geologic Map of the Waynesburg Quadrangle, Southwestern Pennsylvania. U.S. Geol. Survey GQ–838, 1970, 1 p.

Table 6.—Pennsylvania: Anthracite production and value by counties

County	Production (thousand short tons)				Total value, (thousands)
	Underground	Strip	Bank	Total [1]	
Carbon	21	253	190	464	$4,530
Columbia	21	257	111	389	4,119
Dauphin	22	-----	66	88	425
Lackawanna	([2])	292	109	402	5,132
Luzerne	572	1,384	892	2,848	33,004
Northumberland	230	484	293	1,007	10,741
Schuylkill	876	1,756	1,374	4,006	43,934
Sullivan	-----	116	-----	116	964
Subtotal [1 3]	1,742	4,542	3,036	9,320	102,843
Dredged production, total [4]	-----	-----	-----	409	2,493
Total, State	1,742	4,542	3,036	9,729	105,341

[1] Data may not add to totals shown because of independent rounding.
[2] Less than ½ unit.
[3] Excludes dredged production.
[4] For Berks, Dauphin, Lancaster, and Snyder Counties.

the total underground production. No significant changes were made in underground mining practices other than in complying with the safe working conditions and dust-control-limit requirements of the Federal Coal Mine Health and Safety Act of 1969, effective March 30 and June 30, 1970, respectively.

Two West German longwall shearer-loader machines, designed to operate on a short face, were compared under similar operating conditions in the 8-foot-thick Bottom Red Ash vein of No. 14 Plane in the Blue Coal Corporations Wanamie No. 19 Colliery. The cooperative research project was sponsored by the Coal Research Board of PDMMI with Blue Coal providing the site and the major funding of the equipment purchases. A Monninghoff Miniko machine was installed on Apr. 8, 1969, and an Eickhoff Mini-Ranger machine, obtained through the U.S. marketer, started work Mar. 26, 1970. The Miniko averaged 110 tons per operating shift with a 14.5-foot-wide cut and 18-foot advance, while the Mini-Ranger with a 21-foot-wide face produced about three times as much as the Miniko.

Run-of-mine material containing 1,151,000 tons of salable product, 66.1 percent of the total underground production, was mechanically loaded by 103 scraper loaders, 20 mobile loaders, 147 conveyor and pit car loaders, duckbills and other self-loading conveyors. An average of 40.2 million gallons of water per day was delivered to the surface by 179 pumps at active mines and at a few inactive mines in which uncontrolled high water levels caused local surface flooding unless pumping was performed. One mine, whose production was 72,085 tons, installed 2,050 new roof bolts.

Strip pits produced 46.7 percent of the total State production. The 1970 strip pit production was 0.8 percent less than in 1969. Equipment used in strip pit and culm bank operations totaled 94 power shovels, 72 of which were diesel powered; 146 draglines, 104 of which were diesel powered; 10 payloaders; and unknown numbers of haulage trucks, scraper loaders and bulldozers. Since 1964, the active anthracite stripping industry has reclaimed about 380 acres annually. Water removed by seven pumps located in strip pits average 22.7 million gallons per day.

Salable products recovered from culm bank material and silt basins accounted for 31.2 percent of the State's total production of anthracite in 1970, and were 6.7 percent less than in 1969.

Anthracite recovered by river dredging accounted for 4.2 percent of the State's total anthracite production and 2.4 percent of its total value. The dredged production was about 23.6 percent less than in 1969. About 78 percent of the dredged production came from the Susquehanna river area and the remainder from the Schuylkill river area.

The anthracite industry consumed 44.95 millian pounds of explosives. 65.2 percent of which was classed as permissibles and the remainder as dynamites. Deep mines used 1,299,000 pounds of permissibles, strip mines used 28,023,000 pounds of processed and unprocessed ammonium nitrate and 15,577,400 pounds of dynamites, and blasting at culm banks used 49,000 pounds of dynamites.

Based on preliminary data the anthracite industry averaged 241 days worked in 1970

with an average of 6,000 men working daily, 73 men more than in 1969. Productivity for all activities, excluding dredging, averaged 6.53 tons per man day compared with 7.31 tons per man day in 1969, while productivity, only for dredging, average 21.76 tons compared with 29.92 tons per man day in 1969. The overall average productivity for the entire anthracite industry was 6.72 tons, 0.99 ton per man day less than the 7.61-ton average in 1969.

Work deaths totaled five compared with 13 in 1969. The frequency rate of fatalities per million man hours was 0.47 in 1970 and 1.29 in 1969. The causes of the 1970 fatalities follow: one, underground by blasting; one each, by outside haulage and by another cause at cleaning plants; and one each, by machinery and electricity in strip mines. Nonfatal, lost-time injuries totaled 485 in 1970 and 492 in 1969; the frequency rate of lost-time injuries per million man hours of exposure was 46.71 in 1970 and 50.14 in 1969.

Innovations in mining methods were described in three publications.[8]

The United Gas Improvement Co. shipped 800 tons of 40-percent-ash and 7,500- to 8,000-Btu content culm-bank solids to a factory in La Rochette, France, where it was tested in a full-scale Ignifluid combustor furnace. Based on the successful test, the company planned to have a 250 megawatt commercial power station on line in 1975. Reportedly this proposed station will be located within 40 miles of culm banks containing 100 million tons of solids. The fuel for the proposed station will be obtained from culm-bank material crushed to 2-inch maximum size and floated at 2.0 specific gravity by heavy media separation to produce fuel comprising 60 percent of the raw feed. The 95-percent-ash content sink solids will be used as fill in existing open pits.

Coal (Bituminous).—The total production of 80.5 million short tons was valued at $585.1 million compared with 78.6 million tons valued at $461.6 million in 1969 and 178.6 million tons in the record-production year of 1918. The average f.o.b. mine value of 1 ton increased to $7.27 from $5.87 in 1969. Open market sales totaled 51.0 million tons and averaged $6.32 per ton at the mine while 29.5 million tons of captive coal averaged $8.90 per ton at the mine.

Thirteen groups or companies produced 47.6 million tons. Six of the groups or companies were captive operations with a total output of 25.2 million tons from deep mines and 0.3 million tons from strip mines. The other seven groups or companies produced 18.4 million tons from deep mines and 3.7 million tons from strip mines, all of which was sold on the open market.[9]

The quantity of product in million tons shipped by type of transportation follows: 56.5, by rail or water; 17.5, by truck; and 5.85, to mine-mouth electric utilities principally by belt conveyor. Unit-train shipments totaled 21.3 million tons, 6.5 percent more than in 1969. On-site consumption totaled 337,224 tons for colliery fuel and miscellaneous uses and 273,519 tons were shipped to adjacent beehive coke ovens. Exports through Philadelphia totaled 297,393 tons.

Active mines totaled 807; 198 were underground, 30 fewer than in 1969; 555 were strip mines, 26 more than in 1969; and 54 were auger mines, seven fewer than in 1969. The new plus-100,000-ton-per-year mines that began production in 1970 eventually will produce 6.2 million tons annually. Productivity for the entire bituminous coal industry averaged 14.42 tons per man day compared with 15.21 tons in 1969.

The number of underground mines by types and their approximate production follows: eight shaft mines, 6,529,000 tons; 43 slope mines, 28,455,000 tons; and 147 drift mines, 20,398,000 tons. Production in 1,000 tons was distributed by seams as follows: Pittsburgh, 26,339; Lower Kittaning, 10,970; Upper Freeport, 9,725; Lower Freeport, 4,459 Sewickley, 1,391; Upper Kittaning, 616; Middle Kittaning, 452; Clarion, C Prime, Brookville, and Redstone seams, 1,024; and unaccounted for, 406.

Mechanical cleaning plants totaling 74, three fewer than in 1969, produced 51.3 million tons of product and 16.9 million tons of refuse. The percentages of cleaned product by origin follows: 81.9, under-

[8] Coal Mining and Processing. Is Automated Semi-longwall Production of Anthracite the Answer? V. 7, No. 8, August 1970, pp. 34–38.
Jones, Donald C. Mammoth Stripping Job Gets Underway. Coal Mining & Processing, v. 7, No. 10, October 1970, pp. 74–76.
Stefanko, Robert, and Edmund H. Watkins. Monorail Haulage System. Min. Cong. J., v. 56, June, 1970, pp. 45–49.

[9] Keystone News Bull. V. 29, No. 2, Feb. 26, 1971, pp. 19–24.

Table 7.—Pennsylvania: **Bituminous coal production by type of mine and county**
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands) [2]
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total [1]	
Allegheny	10	13	------	23	3,912	731	------	4,642	$34,970
Armstrong	21	44	10	75	5,796	1,818	182	7,795	48,311
Beaver	W	W	W	7	W	W	W	219	1,244
Bedford	W	W	------	6	W	W	------	18	106
Butler	W	W	W	36	1,047	901	36	1,984	10,229
Cambria	29	22	------	51	5,764	795	------	6,559	66,919
Centre	W	W	------	22	539	803	------	1,342	7,459
Clarion	W	W	W	67	W	W	W	4,383	21,971
Clearfield	13	81	7	101	1,234	4,537	107	5,879	30,744
Clinton	-----	6	------	6	------	451	------	451	2,642
Elk	W	W	W	18	15	345	42	402	2,392
Fayette	W	W	W	35	W	W	W	1,825	13,754
Greene	18	8	------	26	11,324	263	------	11,586	102,235
Indiana	35	31	8	74	7,145	1,116	128	8,389	60,525
Jefferson	7	51	12	70	235	1,336	92	1,663	10,973
Lawrence	-----	W	W	23	------	853	30	883	4,645
Lycoming	-----	W	------	W	------	66	------	66	287
Mercer	-----	W	------	W	------	226	------	226	1,130
Somerset	W	W	W	89	1,264	2,457	22	3,743	24,774
Tioga	-----	8	------	8	------	885	------	885	4,525
Venango	-----	10	------	10	------	477	------	477	2,110
Washington	W	W	W	31	13,707	753	4	14,464	115,438
Westmoreland	7	22	------	29	2,397	213	------	2,610	17,663
Total [1]	198	555	54	807	55,382	24,447	661	80,491	585,057

W Withheld to avoid disclosing individual company confidential data, included in "Total."
[1] Data may not add to totals shown because of independent rounding.
[2] Value received or charged for coal f.o.b. mine. Includes a value for coal not sold but used by producers, such as mine fuel and coal coked, as estimated by producers at average prices that might have been received if such coal had been sold commercially.

ground mines; 18.0, strip mines; and 0.1, auger mines. Wet washing equipment other than jigs produced 30.9 million tons distributed approximately in million tons as follows: tables, 6.0; launders, 2.1; froth flotation, 2.1; dense medium, 19.5; and classifiers, 1.2. Jigs accounted for 12.3 million tons; and pneumatic-type equipment produced 8.2 million tons. The annual capacity of all bituminous-coal mechanical-cleaning equipment purchased in 1970 for use in the State was 3,272,500 net tons based on a 7-hour day and 220 days per year. This capacity equals 2,125 tons per operating hour. The salable product from preparation plants averaged 135.3 tons per man day compared with 142.7 tons in 1969.

Dried coal totaling 6.14 million tons was produced by 11 thermal drying units in nine plants.

Crushed coal totaling 37.0 million tons came from 154 plants.

Underground mines produced 55.38 million tons, 1.2 percent less than in 1969. Continuous mining machines totaling 464, six more than in 1969, produced 46.12 million tons, 0.89 million tons more than in 1969. These machines included ripper, boring, oscillating-disc-head, and rotary drum types. Because some continuous mining machines were not capable of loading raw coal, 63 mobile loaders were teamed with them to load 2.06 million tons from mine floors. The other continuous mining machines loaded 5.20 million tons onto feeder conveyors and 38.85 million tons into shuttle cars and rubber-tired mine cars.

One planer longwall and nine shearer-loader installations mined and loaded 1.92 million tons, 0.05 million tons less than in 1969. These 10 installations were operated by five companies in seams ranging from 43 to 78 inches in thickness under 200 to 800 feet of cover. The blocks of coal mined ranged from 400 to 600 feet in face length and from 2,550 to 2,880 feet in panel depth. The number of men for one crew shift ranged from seven to 10, and run-of-mine coal mined during one crew shift ranged from 700 to 1,277 tons.

Four mobile loaders discharged 48,374 tons directly into mine cars or onto conveyors, and 6,871,843 tons were dumped into shuttle cars by 85 mobile loaders. The remainder of the mechanically loaded coal (79,322 tons) was handled by duckbills and scraper conveyors.

A total of 154 cutting machines, 55 fewer than in 1969, were used to cut

7,608,642 tons. Coal shot from the solid or cut by hand totaled 11,854 tons, 82 percent less than in 1969.

Coal drilling by 128 hand-held or post-mounted drills, 32 fewer than in 1969, was used to produce 4,762,232 tons, while 12 mobile drills, 23 fewer than in 1969, were used to produce 1,942,557 tons. Roof bolting employed 271 rotary drills, 33 fewer than in 1969, and 291 percussion drills, 18 more than in 1969. Roof or rock drills used for other purposes included 23 rotary drills, six more than in 1969, and 44 percussion drills, 11 more than in 1969.

Approximately 1,126,000 pounds of permissible explosives were consumed in underground mines for blasting 6.7 million tons of coal and for other purposes.

Eighty mines installed 9,650,140 roof bolts, all new, as either the sole method of roof support or in conjunction with other support materials. These 80 mines produced 61,629,940 tons of coal including 54,162,940 tons produced under roof supported only by bolts.

Less than half the haulage of raw coal and operating supplies was done by 975 trolley locomotives, five more than in 1969, by 50 battery locomotives, five more than in 1969, together with 13,311 mine cars of 3.3-ton average capacity, 565 fewer than in 1969, operating on 668 total miles of track, the same mileage as in 1969.

The larger part of the haulage was performed by 562 gathering and haulage conveyors, 12 fewer than in 1969, totaling 199.6 miles in length compared with 206.1 total miles in 1969. Considerable intermediate haulage was done using 1,013 cable-reel and 27 battery shuttle cars, 13 smaller capacity shuttle buggies, 126 rubber-tired tractors, 286 rubber-tired trailers, and 187 rubber-tired mine cars averaging 1.8 tons capacity.

Shipments of new equipment to the State's deep mines in 1970 included seven mobile loaders, 54 continuous mining machines, two longwall units, 102 shuttle cars, 77 gathering and haulage conveyors, and unknown numbers of rubber-tired tractors, trailers, and roof drills.

The 55.4 million-ton underground production averaged $8.12 per ton f.o.b. mine compared with the 56.0-million-ton production at $6.53 per ton f.o.b. mine value in 1969. Washington and Greene Counties produced 25.0 million tons or 45.2 percent of the State's underground production. About 19.5 million tons of the deep mined coal produced in these counties was captive.

Productivity at underground mines averaged 12.28 tons per man day compared with 13.92 tons in 1969.

A world record in coal production from a longwall face was achieved at the Cambria Division's Mine 33 of the Bethlehem Mines Corp. In one 24-hour period, 7,050 tons were produced from a 600-foot face in the 54-inch-thick Lower Kittanning "B" seam under 800 feet of cover.

The Helvetia Coal Co.'s Lucerne No. 6 mine was the first in the State to receive approval for nominal 1,000-volt AC power for both longwall and continuous miners.

A portable device for the continuous measurement of coal dust particles was developed by a Pennsylvania State University scientist under contract with the State's Coal Research Board.

Gray and Myers gave a detailed discussion of support methods successfully used for preventing subsidence in the case of new construction over shallow-depth mine workings in the Pittsburgh area.[10]

Strip mining equipment included 570 power shovels, the same number as in 1969, and 364 draglines, 49 more than in 1969. About 97 percent of the shovels and draglines were diesel powered and 79 percent had capacities of 5 cubic yards or less. Of the 10 carryall scrapers in use, 18 fewer than in 1969, nine had capacities of 5 cubic yards or less. Other equipment included 705 bulldozers, 40 horizontal drills, 138 vertical drills, 177 front-end loaders, 11 wheel-excavators, six power brooms, 41 motor graders, and one coal drill. No data were available for the truck haulage of raw coal.

Productivity at strip mines averaged 23.26 tons per man day compared with 22.66 tons in 1969.

The 24.4-million-ton strip mined production averaged $5.38 per ton f.o.b. mine compared with the $4.24-per-ton value for the 22.0-million-ton production in 1969. About 3.5 percent of the production was captive. Clearfield and Clarion Counties produced 8.9 million tons, or 36.5 percent

[10] Gray, Richard E., and J. F. Myers. Mine Subsidence and Support Methods in the Pittsburgh Area. J. Soil Mechanics and Foundations Div. Proc., American Soc. Civil Eng., v. 96, No. SM4, July 1970, pp. 1267–1287.

of the State's total strip mined production. The Fox mine of the C & K Coal Co. was the largest producer with 2,014,000 tons.

According to the Pennsylvania Dept. of Environmental Resources, the area of lands reclaimed annually since 1964 by active bituminous coal strip mining operators has averaged about 10,000 acres in a range of 9,500 to 10,900 acres. Most of the reclamation was classed as terrace backfilling. In 1970 about 7.5 million trees were planted on about 6,500 acres, while grasses were planted on about 4,000 acres using as much as 400 pounds of 10-20-10 fertilizer per acre. Reportedly, the total cost for grading and backfilling strip mined land in recent years averaged $486 per acre in 108 projects totaling 3,736 acres.

Strip production in 1,000 tons was distributed by seams as follows: Kittaning, 9,424; Freeport, 4,655; Clarion, 2,970; Pittsburgh, 1,635; Brookville, 1,137; Redstone, 365; and Bakertown, Big A, Brush Creek, C-Prine, Clay Rider, Fulton, Miller B, Seymour-Bloss, Uniontown, Walters, and Waynesburg seams and unaccounted for, 4,261.

Strip and auger mining consumed 7.9 million pounds of permissible explosives, 6.2 million pounds of dynamites, and 69.3 million pounds of processed and unprocessed ammonium nitrate for blasting purposes.

Active equipment for auger mining included 48 augers, three bulldozers, five horizontal drills, three diesel shovels rated at less than 5-cubic-yard capacity, two front-end loaders and one wheel excavator. Auger mines owned 55 coal-recovery augers in 1970.

The 661,000-ton auger-mined production averaged $5.51 per ton f.o.b. mine compared with the $4.04 per ton f.o.b. mine value for the 622,000-ton production in 1969. Armstrong and Indiana Counties produced about 310,000 tons or 47 percent of the State's auger-mined production. Only 2.9 percent of the total auger production was captive. Production in 1,000 tons was distributed by seams as follows: Freeport, 453; Kittaning, 197; and Miller B, Clarion, and Pittsburgh, 11.

Productivity at auger mines averaged 34.08 tons per man day compared with 43.25 in 1969.

The State's electric utilities received 28,381,000 tons of bituminous coal in 1970. A long-term contract made Greenwich Collieries Co. the sole supplier of coal to be hauled in 13,000-ton unit trains from the new Lancashire No. 26 mine to the 765-megawatt Pennsylvania Power and Light Co. powerplant near Washingtonville in Montour County. The combined investment in the new mine and powerplant was $264 million. At yearend the mine was producing 4,000 tons per day, with production planned to reach 17,000 tons per day by 1975.

The North American Coal Corp. contracted to deliver 20 million tons of coal from its Johnstown-area reserves to several Pennsylvania Power and Light Co. plants. The Oneida Mining Co., an affiliate of North American, will own and operate the mine from which coal will be shipped in the utility's fleet train.

The Florence Mining Co. simultaneously operated two mines in two seams of the same underground property in Indiana County to supply about 2 million tons of coal by belt conveyor to the partially completed Conemaugh steam-electric plant at Huff. This plant, owned by nine power companies will have two rail-mounted, bucketwheel, coal-stacker reclaimers. The 12,200-Btu coal delivered was prepared using scalping screens, rotary breakers, and air tables. It was planned for this mining company to supply 80 to 100 percent of the 5-million-ton annual requirement for the Conemaugh plant when it is completed.

The first two of three 540,000-kilowatt generating units were in operation at yearend at the Hatfield's Ferry power station near Masontown. When in full operation in 1971, the 1,620,000-kilowatt station will require 4.5 million tons of coal annually.

Two developments were in progress during 1970 that could affect the future pattern of coal-fueled power generation in the State. First, the investigation of a reliable technique for the underground transmission of electricity at voltages as high as 750-kilovolts was the specific objective of the Electric Research Council's research program conducted at Waltz Mill by Westinghouse Electric Corp. under contract with Edison Electric Institute. Because accelerated life tests and other evaluations required a 1,100-kilovolt energy source, the project also was a test of the technical and economic feasibility of million-volt over-

head transmission. Second, two nuclear-powered experimental plants commissioned before mid-1967 at Shippingport and Delta had a total generating-capacity of 130 megawatts (MWe) and five units with a total generating capacity of 4,618 MWe were under construction and scheduled for commercial operation in the 1972–73 period. This amount of generating capacity, if fueled by bituminous coal, would require 11 to 13 million tons annually. The Peach Bottom plant at Delta, owned by the Philadelphia Electric Co., was the only operating gas-cooled reactor in the United States.

Safe-working-condition regulations and dust-control limits of the Federal Coal Mine and Safety Act of 1969 became effective March 30 and June 30, respectively.

Accidents incurred by the State's bituminous coal industry included 31 fatalities, five more than in 1969, and 1,170 nonfatal lost-time injuries, 97 more than in 1969. Injury rates for one million man hours of exposure were 0.70 fatal compared with 0.63 fatal in 1969, and 26.50 nonfatal compared with 25.90 nonfatal in 1969.

On a million-ton-production basis, injury rates were 0.38 fatal compared with 0.33 in 1969, while the nonfatal rate was 14.53 compared with 13.64 in 1969.

In 1970, underground mine fatalities totaled 27; 15 by falls of roof, one by the fall of face, side, rib or pillar, five by haulage, one by gas and dust explosion, one by electricity, three by machinery, and one by surface haulage related to underground mining. Strip mines had two fatalities, one of which was caused by machinery. Auger mines had no fatalities. Preparation plants had two fatalities, one of which was caused by machinery.

The trophy winner in the 1970 underground coal mine contest of the 46th National Safety Competition was the Robena No. 1 Mine, United States Steel Corp., Carmichaels, Greene County, for 671,438 man hours without a disabling work injury.

Coke.—Eight companies operated 11 oven-coke plants, one classified as merchant and 10 as furnace. Collectively, these 11 plants carbonized 26,352,000 short tons of coal, including 14,830,000 tons of bituminous coal and 71,200 tons of anthracite produced in the State, to produce 18,212,000 short tons of breeze-free metallurgical coke, 95.6 percent of which was blast furnace grade valued at $32.57 (average) per ton, and coproducts and byproducts comprising coke breeze, gas, nitrogen fertilizers, tar, pitch, naphthalene, and crude light oil and its derivatives.

Four beehive-coke plants in two counties produced 444,069 tons of coke, principally for blast furnaces, using 745,654 tons of coal of which 472,135 tons were not mined by the beehive-oven operating companies.

Ten iron and steel works operated by seven companies, had integral oven-coke plants with a total of 3,361 slot-type ovens, 1,375 of which were in the world's largest coke plant at Clairton. Another raw iron and steel producer obtained blast furnace coke from the parent company's oven-coke at Fairmont, W.Va., and from a subsidiary's 264 beehive ovens at Templeton, Pa. Coal used in the beehive oven plant was handled through a gravity flow bin installation developed by Bituminous Coal Research, Inc. This type of bin is the second one installed at U.S. beehive coke plants. Pennsylvania ranked first in U.S. oven-coke production with 28.04 percent of the total.

Exports of coke through Philadelphia totaled 465,180 tons.

A 10,000 square-foot facility employing 25 persons for the processing of coke was announced by Limewood Inc., at Boyers in Butler County.

Natural Gas Liquids.—Production of natural gas liquids decreased 7 percent below that of 1969, to 53,000 barrels. Of the total production, 19,000 barrels were natural gasoline and cycle products and 34,000 barrels were liquefied petroleum (LP) gas. LP gases averaged $2.56 per barrel compared with $2.23 in 1969, and natural gasoline and cycle products averaged $2.63 per barrel compared with $2.77 in 1969.

According to the Oil and Gas Division, Pennsylvania Bureau of Topographic and Geologic Survey, proved reserves of natural gas liquids totaled 896,000 barrels at yearend 1970 compared with 974,000 barrels at yearend 1969. Two natural gas processing plants processed 3.3 million cubic feet of gas and recovered 150 barrels of liquid daily.

The Statistical Committee of the Natural Gas Processors Association in its 1971 LP-gas (LPG) storage survey reported the State's total capacity for underground LPG storage as 1,091,000 barrels. One company in Delaware County used caverns mined in granite to store 500,000 barrels of butane,

400,000 barrels of propane, and 75,000 barrels of propylene. In Westmoreland County, one company used a mined cavern for storing 116,000 barrels of n-butane. One gas works in Philadelphia County had 54 aboveground tanks for storing 1,620,000 barrels LPG.[11]

Peat.—Eleven operations in seven counties reported a total production of 49,284 short tons, 24.4 percent more than in 1969. The total production comprised 1,863 tons unprepared, 45,171 tons shredded only, and 2,250 tons kiln-dried only. Lackawanna County was the leading producer with 15,000 tons followed by Luzerne County with 11,928 tons. The other producing counties were Columbia, Erie, Lawrence, Monroe, and Wayne.

Sales, totaling 43,793 tons at an average value of $11.81 per ton, were 23.5 percent greater and averaged 5 cents per ton more than in 1969. Sales of bulk peat for general soil improvement totaled 26,159 tons and averaged $10.20 per ton. Total sales by type included 7,775 tons of moss, 17,628 tons of reed sedge, and 18,390 tons of humus.

Research findings on existing peat accumulations by Given emphasized the importance of ecology in the conversion of peat to Pennsylvania coals differing considerably in properties.[12]

Petroleum and Natural Gas.—Crude petroleum production was 8.0 percent less than in 1969 despite the startup of several new water-flood projects. The average value, $4.52 per barrel at the well, was the same as in 1969. In 1970, as in the last 7 years, because the production of Pennsylvania-grade crude petroleum exceeded the producing companies' refining capacity, some of this crude oil was sold at unfavorable prices to other refiners. However, the current expansion of refining capacity and a sales program, making Pennsylvania-crude-based lubricants available throughout the United States, was expected to balance the excess production.

The number of petroleum-producing wells, all of which were strippers on 632,034 acres, decreased to 36,801 from the 37,625 total in 1969.

The State's crude petroleum production comprised 4,028,000 barrels of Pennsylvania grade valued at $18,302,750, and 65,000 barrels of Corning grade valued at $197,250 produced in Crawford and Erie Counties from the Medina (Lower Silurian) Sandstone.

Proved reserves of crude oil decreased 3.4 million barrels during 1970, to 51.3 million barrels at yearend. Indicated reserves of crude oil economically available by fluid injection totaled 32.8 million barrels.[13]

Natural gas production totaled 76.8 billion cubic feet, a decrease of 2.9 percent from that of 1969, while its average value increased 3 mills, to 27.9 cents per thousand cubic feet. A total of 61.7 billion cubic feet of gas was produced from the shallow (Upper Devonian or younger) reservoirs, while production from the deep (Middle Devonian or older) reservoirs, totaled 15.1 billion cubic feet. The estimated total number of producing gas wells decreased from 16,600 in 1969 to 16,548 in 1970. Estimated proved reserves of natural gas totaled 1,378 billion cubic feet, including 585 billion cubic feet in storage at yearend in 65 pools, serviced by 2,139 wells and equal to approximately 14 percent of the U.S. reservoir capacity. This was an increase in all reserves of 74 billion cubic feet above those of 1969.

The American Petroleum Institute reported that 774 new wells were drilled during 1970 for a total of 1,433,248 feet.[14] Of these, 441 were oil wells with 435,697 feet, 250 were gas wells with 829,090 feet, 32 were dry wells with 91,376 feet, eight were stratigraphic or core wells with 11,884 feet, and 43 were service wells with 65,201 feet. Exploratory well drilling totaled 152,061 feet for 40 wells distributed among two oil wells with 1,950 feet, 21 gas wells with 91,625 feet, and 17 dry wells with 58,486 feet. Development well drilling totaled 1,204,102 feet for 683 wells distributed among 439 oil wells with 433,747 feet, 229 gas wells with 737,465 feet, and 15 dry wells with 32,890 feet. Wells completed as multiple completions included 17 exploratory wells in 57 zones with 62,970 feet and 254 development wells in 741 zones with 610,070 feet. Seven new-field wildcat wells were drilled; one was a gas well with 3,990

[11] Oil and Gas Journal. V. 69, No. 10, Mar. 8, 1971, pp. 87–92.

[12] Given, Peter H. The Mysterious Peat—Precursor of Coal. Coal Mining & Processing, v. 7, No. 8, August 1970, pp. 47–48.

[13] Oil and Gas Journal. V. 69, No. 14, Apr. 5, 1971, pp. 38–39.

[14] American Petroleum Institute. Review of Drilling Statistics—Annual Survey, 1969. V. III, No. 4, March 1970, p. 19. Annual Survey, 1970. V. IV, No. 4, March 1971, pp. 14–17, 19, 21, 22.

Table 8.—Pennsylvania: Oil and gas well drilling completions by county

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Armstrong	0	29	2	0	3	0	34	95,872
Blair				0	0	2	2	9,173
Beaver	1	0	0				1	1,732
Butler	3	2	0	0	0	2	7	17,570
Cambria	0	4	1				5	34,097
Clarion	3	10	0				13	20,327
Clearfield	0	11	0	0	3	3	17	56,958
Crawford	2	14	0				16	57,896
Elk	3	4	0				7	12,653
Erie	0	3	0				3	9,698
Fayette	0	1	0	0	0	1	2	7,225
Forest	30	4	1	1	0	1	37	27,177
Greene				0	1	0	1	845
Indiana	0	119	1	0	8	1	129	456,713
Jefferson	0	20	4	0	4	1	29	85,164
Lycoming				0	1	0	1	3,990
McKean	84	2	1				87	157,968
Potter	3	0	0				3	3,965
Somerset				0	0	1	1	4,498
Venango	141	0	1				142	100,798
Warren	168	0	1	1	0	3	173	152,808
Washington	1	0	1	0	1	1	4	11,062
Westmoreland	0	5	2	0	0	1	8	26,575
Wyoming	0	1	0				1	1,399
Total	439	229	15	2	21	17	723	1,356,163

Source: American Petroleum Institute.

feet and six were dry wells with 18,982 feet. The total number of exploratory and development wells drilled was 723, compared with 895 wells drilled in 1969, and the total footage drilled in such wells in 1970 was 298,418 feet less than the 1,654,581 feet drilled in 1969. In late January one rotary drill was active, and from late September to mid-November, 15 were active. Active rotary-drill weeks totaled 367.

New field discoveries of natural gas totaled 500 million cubic feet while new reservoir discoveries in old fields totaled 2,400 million cubic feet. New field discoveries of petroleum totaled 558,000 barrels.

Of the 62 wells drilled deeper, 30 were gas wells, 12 were oil wells, two were dry wells, and 18 were gas storage wells.

Deep drilling (Middle Devonian or older) increased from 43 wells in 1969 to 90 wells in 1970, including 18 wells drilled deeper. Most of the deep development drilling was in the Medina gas area of Crawford County where 14 gas wells were drilled in the Indian Springs field. Most of the activity in the shallow gas reservoirs was in Indiana, Armstrong, and Jefferson Counties, where development continued in the Big Run and Marchand fields. Shallow-oil drilling was carried on in the Bradford field of McKean County in the Bradford and associated sandstones. Oil wells totaling 161 were drilled in the Red Valley and Venango Second sand areas of Venango and Forest Counties. Warren County was the most active oil area, with 169 successful wells completed in 1970. Indiana County was the most active gas area with 119 successful wells completed. Seismic crews put in 45 crew weeks during the year compared with 39 crew weeks in 1969. State Forest lands totaling 10,458 acres were leased through competitive bidding in a range of $2.08 to $5.11 per acre. A total bonus of $37,211.52 was received. The yearly rental on this land was $1.00 per acre. At yearend there were 126,152 acres of State Forest lands under lease for oil and gas exploration development, including 59,109 acres in gas storage. No new tracts of State Game lands were leased during 1970. At yearend 27 leases were active, totaling 12,727.5 acres. There were 39 productive wells on 20 leases of State Game lands.[15]

The Peoples Natural Gas Company and seven participators drilled the No. 1 Martin Well to a depth of 15,573 feet in Wayne Township, Armstrong County. The well was plugged back to a depth of 6,850 feet and completed as a discovery in the Goheensville field of the Snydersville

[15] The Oil and Gas Division, Pennsylvania Bureau of Topographic and Geologic Survey.

Chert-Oriskany Pool. The discovery well's open flow after fracturing was 1.1 million cubic feet per day at a 7-day shut-in rock pressure of 3,325 pounds per square inch.

The first Maraflood project in the State was being expanded to 50 acres by Penzoil United, Inc., and the Kendall Refining Co. A second project, covering 40 acres, was started in May by the Quaker State Oil Refining Corp. in Warren County in the Goodwill Hill field at a 600-foot depth.

The improved recovery of Pennsylvania crude oil by gas flooding was described by Frohne.[16]

Any chance for oil exploration on the U.S. side of Lake Erie was eliminated by Pennsylvania's cancellation of agreements on a 4,877-acre block in the lake. Pan American Petroleum Corp. of Tulsa, Okla., in June, and Ranger Oil Ltd. of Alberta, Canada, in December, released their rights. New York and Ohio dropped plans for holding lease sales on their portions of the lake owing to antipollutionist opposition.

The United Refining Co. awarded a $7.5 million contract to Williams Bros. Eng. Co., Tulsa, Okla., to build a new 12-inch crude oil pipeline from Buffalo, N.Y., to its Warren refinery. This line, connecting with the Interprovincial Pipe Line Co. of Canada's system, will replace an obsolete 30-mile, 8-inch section of a common-carrier system owned by the Buckeye Pipe Line Co.

The Sun Oil Co. awarded Stone & Webster Engineering Corp. a $100 million contract to design, engineer, and construct a giant petrochemical complex at Marcus Hook. When completed, this complex will require 34,000 barrels per day of naphtha and gas-oil feedstocks obtained from the company's refinery and domestic purchases. Built-in flexibility will offer the optional use of imported feedstocks.

Eleven companies operated 13 petroleum refineries, four in eastern Pennsylvania adjacent to the Delaware river and nine in six northwestern counties. The four eastern refineries and the one at Warren were rated at 616,000-barrels of total crude-feed capacity per calendar day. These five refineries processed about 225 million barrels of interstate and foreign, asphalt-base crude oils, principally into liquid fuels, and about 6.8 million barrels of lubricants. Lubricants were produced at two of the eastern refineries in a quantity equal to about 6 volume percent of their crude run to stills.

The other eight refineries in Northwestern Pennsylvania continued operations quite small in scale compared with most other refineries in the United States. Collectively, these refineries were rated at 35,200 barrels of crude-feed capacity per calendar day. Their 12.8-million-barrel feed, 5.4 percent of the State's total, was paraffin-base Pennsylvania-grade crude only, of which 4.0 million barrels came from wells in the State and 8.8 million barrels from wells in western New York, Ohio, and West Virginia. The Bradford field alone, in Pennsylvania and New York, produced 2.9 million barrels. One of the eight refineries, a white oil producer at Franklin, was severely damaged by fire and explosion in June and terminated all activities in October. Collectively, these eight refineries produced about 4.0 million barrels of lubricants equaling six percent of the U.S. production, and about 8.6 million barrels of other petroleum products. Expansions were in either the planning or construction stage at the Pennzoil United, Inc., refinery at Rouseville, where a hydrogenation unit will be built, and at the Witco Chemical Corporation's Kendall division at Bradford, where a dewaxing unit requiring 51,000 square feet and 35 employees was completed.

NONMETALS

Cement.—A decline in building and construction activities, particularly near the eastern seaboard, contributed to decreased production of portland and masonry cements compared with those of 1969.

Portland cement production at 22 plants was down 8.9 percent and its value was 4.6 percent less despite an average increase in value of 13.2 cents per 376-pound barrel. Masonry cement production at 20 plants was 9.1 percent less and its value decreased 2.1 percent despite an average increase in value of 21.2 cents per 280-pound barrel.

For the purpose of cement surveys, Pennsylvania is divided into western and eastern producing districts which are separated by the eastern boundaries of Potter, Clinton, Centre, Huntingdon, and Franklin Counties.

[16] Frohne, K. H. Gasflood Improved Appalachian Recovery. Petrol. Eng., v. 42, No. 7, July 1970, pp. 79, 82, 84.

The five plants in the western district shipped 10.0 million barrels of all types of portland cement, at an average value of $3.13 per barrel, of which 96 percent was type I–II (general use and moderate heat); 3 percent was type III (high early strength); and 1 percent comprised waterproof-portland, slag, expansive, and white types. Shipments in million barrels by methods follow: 9.0, by truck in bulk; 0.5, by truck in containers; and 0.5, by railroad in bulk. Stocks of all types of portland cement at yearend totaled 2.0 million barrels. Purchases of western district portland cement in percentage follow: 95, by ready-mixed concrete companies; 3, by highway contractors; and 2, by miscellaneous. One million barrels of masonry cement shipped had an average value of $2.92 per 280-pound barrel. Although no white cement was produced by the western district plants, they did purchase some from eastern district plants.

Production of portland cement exceeded shipments by 296,000 barrels in the western district and 448,000 barrels in the eastern district. Production of masonry cement exceeded shipments by 1,000 barrels in the western district and 47,000 barrels in the eastern district.

The State's apparent consumption of portland cement was 17.25 million barrels (42 percent of the total production) while the apparent consumption of masonry cement was 964,000 barrels (34 percent of the total production).

A total of 17 plants in the eastern district produced 30.9 million barrels of all types of portland cement at an average value of $2.90 per barrel, of which 89 percent was type I–II (general use and moderate heat); 6 percent was type III (high early strength); and 5 percent was waterproof-portland, white, block, portland-pozzolan, and expansive. Shipments in million barrels by methods follow: 19, by truck in bulk; three, by truck in containers; eight, by railroad in bulk; and one, by railroad in containers. Stocks of all types of portland cement at yearend totaled 2.0 million barrels. Purchases of eastern district portland cement in percentages follow: 93, by ready-mixed concrete companies; 5, by highway contractors; and 2, miscellaneous. Shipments of masonry cement totaled 2.0 million 280-pound barrels at an average value of $2.99 per barrel. White cement was produced by two plants in the eastern district.

Western district plants consumed 421,940 short tons of cement rock and 2,533,310 tons of limestone, and eastern district plants consumed 7,114,874 short tons of cement rock and 1,872,135 tons of limestone. Collectively, all plants in both districts consumed 1,004,771 short tons of other raw materials, including shale, clay, sand, gypsum, iron ore, kaolin, and mill scale. All plants in the State consumed 12,977,030 short tons of raw materials to produce 8,083,452 short tons of portland and masonry cements. Shipments of pyrite cinders for cement manufacture from one chemical plant in Fayette County were about 78 percent less both in quantity and value compared with 1969.

Electricity purchased, in million kilowatt-hours, totaled 285 in western district plants and 742 in eastern district plants. Eastern district plants generated 99 million kilowatt-hours.

Northampton County was the major shipper of portland cement with 44 percent of the State's total, followed by Lehigh County. Other counties shipping portland cement were Allegheny, Butler, and Lawrence in the western district, and Berks, Montgomery, and York in the eastern district. Northampton County led in the shipment of masonry cement with 30 percent of the State's shipments.

The conversion of kiln firing from coal to Bunker C fuel oil was completed at the Cementon plant of The Whitehall Cement Mfg. Co.

The Allentown Portland Cement Co. at its Evansville plant completed a modernization program that included the installation of 6,000 feet of belt conveyors and 1,400 feet of bucket elevators.

The Medusa Portland Cement Co. in a $11-million expansion program at its Wampum plant installed a 250,000-barrel-capacity clinker-storage building, a new kiln larger than the other two at the plant, a finishing mill building, three new silos, and an enlarged electric substation. The plant's annual production capacity was increased from 2.7 to 4.1 million barrels.

The Lehigh Portland Cement Co.'s plant at Fogelsville and the Giant Portland Cement Co.'s plant at Egypt were reportedly shut down. The high cost of bringing these plants up to air-pollution-control standards

and a high labor requirement were major reasons for closing the plants.

Two plants in Northampton County were among the six recipients of the 1970 R. Emmett Doherty Award presented to publicly commend air-pollution-control leaders in the cement industry. The two plants receiving the Award were operated by the Dragon Cement Co. of New Brunswick, N.J., and Universal Atlas Cement of Pittsburgh.

Clays.—Excluding kaolin and compared with 1969, the total production of clays and shales decreased 2.3 percent in tonnage and 19.3 percent in value.

Common clay production, equaling 3.4 percent of total production, was 56 percent less and its value was 41 percent less, despite an average increase in value of 8 cents per short ton.

The production of shale and undifferentiated clay declined 4.2 percent in tonnage and 27.0 percent in value, and accounted for 51.2 percent of the total clay production, the same as in 1969. The average value per short ton declined to $3.43 from $4.62 in 1969.

Fireclay production increased 0.2 percent in tonnage but decreased 18.4 percent in value because the average value per short ton declined from $10.71 in 1969 to $8.72. Fireclay production was 45.4 percent of the total production, compared with 44.2 percent of the total production in 1969.

The State's clay industry operated 84 mines in 29 counties.

The leading counties in the production of all clays and shales, with 52.0 percent of the State's total were Lawrence, Clearfield, Berks, Armstrong, and York.

Berks, Luzerne, York, Lawrence, and Northumberland Counties were the leading producers of shale and undifferentiated clays with 59.8 percent of the State's total production.

Leading counties in fireclay production, with 86.8 percent of the total, were Clearfield, Lawrence, Armstrong, Jefferson, and Fayette.

Kaolin was produced only in Cumberland County by the Philadelphia Clay Co. Production and value were about 9 percent greater than in 1969.

Nearly 79 percent of the production of shale and undifferentiated clay went into the manufacture of vitrified clay products. The remainder was used in the production of cement, lightweight aggregates, refractories, and mortars.

The manufacture of refractories and mortars accounted for 60.6 percent of the fireclay produced. Vitrified clay products used 38.0 percent and the remainder was used in the manufacture of cement, fillers, and pottery.

The Watsontown Brick Co. plant in Northumberland County was updated by the installation of automatic pug mills and gas-firing equipment. Scrap-and-waste production during pugmilling was minimized, and desirable color control was maintained despite the shift from coal firing.

Table 9.—Pennsylvania: Clays sold or used by producers, by kinds and uses [1]
(Thousand short tons)

Use	Fire clay		Miscellaneous clay	
	1969	1970	1969	1970
Refractories:				
Firebrick and block	665	645	-----	-----
High-alumina brick	W	38	-----	-----
Other	[2] 98	[2] 49	W	W
Heavy clay products:				
Building brick	393	413	1,177	1,062
Vitrified sewer pipe	W	W	64	55
Drain tile	-----	-----	33	25
Undistributed	[3] 50	[3] 63	[4] 246	[4] 314
Total [5]	1,206	1,209	1,520	1,456

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Excludes kaolin.
[2] Includes mortar, foundries and steelworks (bulk), and other refractories (1969).
[3] Includes pottery, floor and wall tile, portland and other hydraulic cements, filler (1970), and other uses (1969).
[4] Includes other heavy clay products, lightweight aggregate, filler, foundries and steelworks (bulk), portland and other hydraulic cements, and other uses.
[5] Data may not add to totals shown because of independent rounding.

A deposit of aluminum silicate, the only one of commercial size north of North Carolina, was strip mined by the Narvon Mining and Chemical Co. near New Holland in Lancaster County. The mined product, after drying and screening, was finally graded into a 325-mesh product using air classification. The product was sold in bulk or bags for use as a filler; as an extender; as a diluent and carrier in the manufacture of paints, rubber products, and crop dusting materials; and as parting agents in the rubber and foundry industries. The most important use was for the flocculation treatment of potable and waste waters.

Gem Stones.—Amateur lapidarists and 15 clubs and societies collected mineral specimens principally as a hobby. There was a resurgence in the use of anthracite for decorative carvings. Other semiprecious materials collected were copper-rhyolite, williamsite, a red triassic conglomerate used for book ends and tabletops, and quartz crystals for earrings and pendants.

Glass.—Announcements of additional glass producing facilities were made by Diamond Glass Co., Royersford, Montgomery County, and by the C. E. Glass Co. Inc., Floreffe, Allegheny County.

Graphite.—Artificial graphite was manufactured at three plants in two counties. The output, in the form of anodes, electric motor brushes and brush stock, electrodes for the electrical discharge machining process, and miscellaneous items, was produced from petroleum coke, lamp black, pitch coke, hydrocarbon gases, and other raw materials. Compared with 1969, the quantity of graphite produced was 16 percent greater and its value was 20 percent greater.

Gypsum.—Gypsum was calcined by the U.S. Gypsum Co. in Philadelphia County. The production was 24 percent less and its value was 21 percent less than in 1969.

Iron Oxide Pigments.—Finished natural and manufactured iron-oxide pigments were shipped from one plant in Carbon County and two in Northampton County. Compared with 1969, the production was 3 percent greater and its value was about 1 percent greater. Conversely, the nationwide production of finished iron-oxide pigments was 13 percent less both in quantity and value than in 1969.

Yellow iron oxide pigments in the form of sulfur mud were not mined at an open pit in Cambria County.

Lime.—The total production of quicklime and hydrated lime decreased 6.1 percent in tonnage and increased 1.1 percent in value compared with 1969 statistics. The average value of all production increased from $14.41 in 1969 to $15.52 per ton in 1970. The average value of quicklime increased from $14.09 to $15.19 per ton, and that of hydrated lime increased from $16.29 to $17.09 per ton. The steel industry consumed nearly 60 percent of the total production, and chemical and refractory uses consumed about 17 percent. The remainder of the production was distributed among construction, water and sewage treatment, paper, agricultural, and leather tanning markets. Of the 13 plants operated in 10 counties, nine sold or used both quick and hydrated lime, three only quicklime, and one only hydrated lime. Of the total lime sold or used, 63 percent was consumed in Pennsylvania, 18 percent in Maryland, 5 percent each in New Jersey and New York, and 6 percent in other States.

Centre County led in production with three large plants each producing quicklime and hydrated lime.

A 200-ton-per-day expansion of lime-producing facilities was completed at the Cedar Hollow plant of the Warner Co. The expansion included the installation of a 300-ton-per-day rotary-kiln to replace a much smaller unit reportedly one of the first rotary lime-kilns in the United States. The new kiln was provided with a high-temperature glass-fiber baghouse.

The Bethlehem Steel Corp. put into operation a 650-ton-per-day kiln at Annville, Pa., to produce lime for use in basic oxygen furnaces.

Mica.—Residual crude mica occurring as a deposit on schist was mined and processed using dry grinding by the Micalith Mining Co., Inc., at its Hokes mine near Glenville in York County. The air-separated flake mica was used in paints, roofing, greases, electrically insulated welding rods, and rubber and textile coatings. The demand for roofing mica decreased mainly because

of the greater use of higher density talc and sand in roofing formulations.

Mica production remained the same as in 1969, while its value increased about 9 percent. The State was seventh in the national production of mica.

Drilling and trenching were begun at the Aguda Mining Corp. of Pittsburgh at a deposit of fine flake muscovite (mica) on Pequea Creek near Lancaster. Drill holes on the Corporation's 77-acre property went 115 feet into the deposit estimated to contain 35 million tons.

Mullite (Synthetic).—The Remmey Division of A. P. Green Refractory Co. in Philadelphia produced synthetic mullite that was 13 percent less in quantity and 22 percent less in value compared with 1969 figures.

Perlite (Expanded).—Crude perlite shipped into the State was expanded by six companies in seven plants, one each in Allegheny, Delaware, Lancaster, Lehigh, Luzerne, Montgomery, and York Counties. Compared with 1969 figures, the total quantity sold or increased 41.7 percent and its total value increased only 16 percent. The average price in 1970 was $55.98 per short ton compared with $68.19 in 1969. Expanded perlite was sold and used chiefly for building plaster, with other uses being loose fill insulation, concrete aggregate, filler, soil conditioning, filter, cryogenic applications, charbase, refractory, castable insulation, bonding mortars, fire extinguishing powder, a carrier for pesticides, and oil absorbent.

Pyrites.—Pyritic concentrates containing cobalt, some copper, and about 46 percent sulfur were shipped to Bethlehem Steel Corp.'s Sparrows Point, Md., works from the Corporation's Grace and Cornwall magnetic iron ore concentrators in Berks and Lebanon Counties.

At Sparrows Point, Md., the pyritic concentrates were processed to recover sulfur as sulfuric acid and the iron oxide residue was sintered and used with other iron ore as blast furnace feed. The cobalt and copper values were recovered as a sulfate solution devoid of gold and silver during the sulfur-recovery process. The sulfate solution was further processed by the Pyrites Co. Inc., Wilmington, Del. for recovery of cobalt and copper.

Compared with 1969 figures, the quantity of pyrites produced decreased about 35 percent but its value increased about 39 percent.

Quartz (Manufactured).—The P. R. Hoffman Co. in Carlisle prepared quartz crystals for its own uses and sale to other quartz crystal cutters. The quartz crystal was synthesized by growth in autoclaves at pressures in the range of 1,500 to 20,000 pounds per square inch at temperatures ranging from 250° to 450° C, using soda ash solution as the process solvent and Brazilian lasca and defective quartz crystals as the nutrient material. Growth of crystals occurs on natural or manufactured quartz seed plates in a predetermined crystallographic plane. Pennsylvania was one of the large producers of cut quartz crystals for the electronic industry.

Sand and Gravel.—As in 1969, no sand or gravel was produced by crew-contractor or Government-and-contractor operations. Commercial operators totaling 94 used 85 stationary plants, 17 portable plants, and eight dredges. The quantities of sand and gravel in million tons transported from the producing operations included 13.5, by truck; 0.6, by railroad; and 4.4, by waterway.

Compared with the 1969 situation, the total production of sand and gravel increased 2.2 percent, and its value increased 7.8 percent because of a 9.6-cent-per-ton-average increase in value.

The total sand production in 1970 was 0.7 percent less, but its value was 3.2 percent more owing to a 7.4 cent-per-ton-average increase in value. Sand used for building and paving purposes decreased 8 percent in tonnage and 3.4 cents per ton in value in 1970. Ground and unground sands for industrial uses classed as molding, fire and furnace, glass, grinding and polishing, blast, engine, filtration, hydrofrac, enamel, fillers, foundry, pottery, and miscellaneous totaled 2,466,000 short tons and were valued at $7,015,000 compared with 1,859,000 tons valued at $5,921,000 in 1969. The average value of all industrial sands was 34 cents per ton less than in 1969.

The total production of gravel increased 6.2 percent, and its value was 15.2 percent more than in 1969 because of a 13.4-cent-per-ton-average increase in value. All but 13.1 percent of the total gravel production was used for construction purposes.

Table 10.—Pennsylvania: Sand and gravel sold or used by producers, by classes of operations and uses
(Thousand short tons and thousand dollars)

Class of operation and use	1969		1970	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	5,094	$7,811	4,700	$7,749
Fill	89	138	85	113
Fire or furnace	38	132	36	123
Molding	r 158	r 499	102	401
Paving	3,443	5,473	3,158	5,088
Other uses [1]	r 1,663	r 5,290	2,328	6,491
Total [2]	10,487	r 19,343	10,409	19,965
Gravel:				
Building	3,630	5,900	3,501	5,897
Paving	3,476	5,714	3,531	6,523
Miscellaneous	93	157	127	195
Other uses [3]	420	336	935	1,335
Total [2]	7,619	12,108	8,095	13,951
Grand total [2]	18,105	31,451	18,504	33,915

r Revised.
[1] Includes glass, grinding and polishing, blast, engine, filtration (1970), oil (hydrafrac), ground, and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast, fill, and other gravel.

Based on the total production of all sand and gravel, sand in 1970 accounted for 56.2 percent of the total tonnage and 58.9 percent of the total value compared with 57.9 percent of the total tonnage and 61.5 percent of the total value in 1969.

Sand and gravel was produced in 38 counties. Bucks County led the State in production with 18.7 percent of the total commercial tonnage and 17.4 percent of the value. Other leading producers were Westmoreland, Erie, Beaver, Wyoming, and Luzerne Counties.

In the 1970 National Sand and Gravel Association safety contest, covering the period from July 1, 1969, to June 30, 1970, Pennsylvania had six plants reporting no accidents. The companies and their plants awarded the Certificate of Achievement in Safety were the following: Appalachian Stone Div., Martin Marietta Corp., Mercersburg; Burlington, Milton, and Utica Sand and Gravel plants; George F. Pettinos, Inc., Bala Cynwyd; New Freedom plant; Central Builders Supply Co., Sunbury; Selinsgrove sand plant; and Tionesta Sand & Gravel Inc., Hawthorn; and the Tidioute and Tionesta plants.[17]

Stone.—Major stone producing counties were Montgomery, Northampton, Lancaster, Bucks, York, Adams, Berks, Centre, Chester, and Lawrence.

Total production was 1.1 percent less but its value was 2.1 percent more than in 1969 because of a 5.8-cent-per-ton-average increase in value.

Dimension stone produced at 45 operations in 11 counties equaled 1.8 percent of the total stone production and 4.9 percent of its total value. The average value per short ton of all dimension stone decreased from $50.35 in 1969 to $48.19 in 1970. The number of operations in sandstone was 24; in slate, nine; in granite, four; in other stone, four; and in quartzite and traprock, two each. Dimension quartzite, sandstone, traprock (basalt), and other stone were used primarily for irregular shapes and sawed stone; granite for rubble; and slate for blackboards and flagging. Slate accounted for nearly 52 percent of the total production of dimension stone and 68 percent of its total value.

Crushed and broken stone produced at 227 operations in 50 counties equaled 99.8 percent of the total stone production and 95.1 percent of its total value. The average value of this product increased to $1.73 per short ton from $1.67 in 1969. The number of operations in limestone was 158; in sandstone, 31; in traprock, 15; in quartzite, nine; in other stone, eight; in dolomite and slate two each; and in granite, shell, and quartz one each.

[17] Pit and Quarry. V. 63, No. 9, March 1971, pp. 114–115.

Table 11.—Pennsylvania: Stone sold or used by producers, by counties
(Thousand short tons and thousand dollars)

County	1969			1970			Kind of stone produced in 1970
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Allegheny	1	W	W	1	54	W	Sandstone.
Armstrong	5	226	$483	5	249	$562	Limestone.
Berks	13	3,883	5,345	13	3,863	5,659	Limestone, sandstone, shell, traprock.
Blair	12	1,221	2,123	11	1,210	2,110	Limestone, quartzite.
Bucks	22	4,351	6,312	18	4,133	6,430	Limestone, other stone, sandstone, traprock.
Butler	7	1,684	3,640	5	1,738	4,680	Limestone.
Centre	9	3,809	6,268	9	3,278	5,974	Dolomite, limestone.
Chester	12	3,251	5,722	12	2,850	5,153	Granite, limestone, quartzite, sandstone, traprock.
Clinton	3	607	854	2	W	W	Limestone.
Cumberland	6	1,414	2,337	6	1,483	2,443	Limestone.
Dauphin	4	1,348	2,152	4	950	1,465	Limestone, sandstone.
Franklin	5	W	W	5	W	990	Limestone, sandstone.
Huntingdon	5	W	1,283	5	W	1,042	Limestone, quartzite.
Lancaster	15	4,712	7,742	15	4,317	7,685	Limestone.
Lawrence	5	3,217	4,260	5	2,881	3,895	Limestone.
Lebanon	5	2,388	4,165	4	1,039	1,801	Limestone.
Lehigh	10	2,564	3,010	10	2,663	3,951	Limestone, slate.
Luzerne	4	575	878	4	451	W	Quartzite, sandstone.
McKean	1	W	30	1	W	W	Sandstone.
Mercer	2	277	W	2	W	W	Limestone, sandstone.
Mifflin	4	W	462	4	286	380	Limestone.
Montgomery	16	5,423	9,446	16	5,277	9,377	Granite, limestone, other stone, quartzite, sandstone, traprock.
Northampton	19	5,417	10,453	20	5,826	10,637	Limestone, quartzite, slate.
Northumberland	3	260	407	3	306	498	Limestone, sandstone.
Potter	6	3	107	5	3	93	Sandstone.
Schuylkill	3	W	701	4	1,091	1,641	Limestone, quartzite, sandstone.
Somerset	5	961	2,253	5	564	1,593	Limestone, sandstone.
Susquehanna	9	W	W	8	W	606	Sandstone.
Venango	1	W	W	1	W	4	Limestone.
Wayne	2	W	W	2	W	407	Sandstone.
Westmoreland	11	1,527	2,775	11	1,445	2,879	Limestone, other stone, sandstone.
York	10	4,121	8,953	11	4,025	9,312	Dolomite, limestone, slate.
Undistributed [1]	44	13,754	25,565	44	16,259	28,923	
Total [2]	279	66,992	117,726	271	66,241	120,187	

W Withheld to avoid disclosing individual company confidential data.
[1] Includes production for Adams, Bedford, Cambria, Carbon, Clarion, Columbia, Delaware, Elk, Fayette, Fulton, Jefferson, Lycoming, Monroe, Montour, Perry, Snyder, Union, Washington, and Wyoming (1969) Counties, and data indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

In crushed and broken form the major use of granite, limestone, quartzite, sandstone, traprock, and other stone was for road aggregates and road base stone; dolomite for calcined products; and slate, for flour and granules. Crushed and broken limestone accounted for about 75 percent of the production and value of the total crushed and broken stone production. The distribution of the total crushed and broken limestone production by percent and uses follows: 58.8, road aggregates and road base stone; 20.5, cement manufacture; 9.8, flux stone; 3.4, lime manufacture; 3.0, agricultural uses; and 4.5 for 19 other uses.

In both 1969 and 1970 four companies at four operations produced rock dust. The 1970 production totaled 255,127 short tons, 35.8 percent more than the 187,878-ton production in 1969. This increase in rock-dust production is attributed to a requirement of the Federal Coal Mine and Safety Act of 1969 that the amount of noncombustibles in return-air course dust deposits be increased to 80 from 65 weight percent. Also, according to the Bureau's Health and Safety personnel, gassy deep bituminous mines in 1970 were using 20 to 30 pounds of rock dust for each ton of coal produced in lieu of the 15 to 20 pounds used in 1969.

One operation at Delta in York County produced roofing aggregates and fillers from slate.

The York Stone Co. at its York plant installed an air-swept roller mill complete

Table 12.—Pennsylvania: Stone sold or used by producers, by uses
(Thousand short tons and thousand dollars)

Use	1969		1970	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone	72	$1,781	68	$1,432
Curbing and flagging	22	754	25	758
Other uses [1]	31	3,759	29	3,688
Total [2]	125	6,294	122	5,879
Crushed and broken stone:				
Bituminous aggregate	4,831	7,872	4,276	7,709
Concrete aggregate	5,886	8,561	10,150	16,293
Dense graded road base stone	13,268	19,928	9,224	13,386
Macadam aggregate	1,575	2,355	1,667	2,549
Surface treatment aggregate	2,371	3,535	2,526	3,471
Unspecified aggregate and roadstone	14,650	23,680	13,481	22,102
Agricultural limestone	1,423	3,776	1,825	5,711
Filler stone	W	W	[3] 670	[3] 1,342
Flux	5,075	9,740	5,681	10,953
Railroad ballast	576	987	775	1,237
Refractory stone	W	W	252	1,732
Riprap and jetty stone	132	192	122	194
Other uses [4]	17,079	30,804	15,470	27,629
Total [2]	66,866	111,432	66,119	114,308
Grand total [2]	66,992	117,726	66,241	120,187

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes monumental, roofing slate, millstock, and uses not listed or unspecified.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes sandstone.
[4] Includes stone used in cement and lime manufacture, filler, chemical, whiting (1970) roofing aggregates (1970), mine dusting (1970), refractory (1969), and other uses in smaller quantities.

with air heater, automatic controls, and dust-collection equipment. The plant produced bituminous paving chips, coal-mine rock dust, agricultural limestone, fertilizer filler, and silica sand from quartz.

Several geologists investigated the musical ring produced by some Bucks County rocks when tapped with a hammer. The phenomenon was attributed to elastic strain and abnormal stress resulting from slow mineralogical alterations induced by environmental changes that prevent moisture retention and subject the rocks to wide temperature variations.[18]

Sales of all types of explosives to the State's stone producing industry totaled 39.0 million pounds, nearly half of which was processed and unprocessed ammonium nitrate.

The three runners-up without a disabling work injury in the 1970 quarries contest of the 46th National Safety Competition were the following: McCoy Quarry, Bethlehem Mines Corp., Bridgeport, Montgomery County, for 220,229 man-hours; Hillsville Quarry, United States Steel Corp., Eastern Limestone Operations, Lawrence County, for 197,291 man-hours; and Charmian Quarry, GAF Corp., Industrial Products Div., Blue Ridge Summit, Adams County for 167,651 man-hours.

Sulfur.—Sulfur and hydrogen sulfide were recovered from gases at four oil refineries in two counties. The Claus or modified Claus process was used to recover the sulfur and one plant also recovered hydrogen sulfide using monoethanolamine in a Girdler system. Sulfur recovery was 5 percent less and its value was about 21 percent less than in 1969. Stocks of sulfur at yearend were 72 percent less than at the beginning of the year. Hydrogen sulfide production was 23 percent less and shipments were 21 percent less than in 1969.

Two occurrences of native sulfur found in the State during 1970 were of unusual interest. Near Columbia in Lancaster County, large pyrite crystals altered to limonite cubes contained pale yellowish-green masses of sulfur belonging to the orthorhombic crystal system as shown by an X-ray pattern. The other occurrence was at the Kehley's Run Mines near Shenandoah Heights in Schuylkill County. There,

[18] Science News. V. 98, No. 24, Dec. 12, 1970, p. 453.

fumes escaping from burning underground coal deposited sulfur crystals at the surface. The crystals were pale yellow to pale greenish yellow, very small, and in groups of needle like aggregates.[19]

Talc (Sericite-Schist).—A small tonnage of sericite schist, which resembles talc mineralogically and is suitable for many of the same uses because of similar chemical and physical properties, was mined from an open pit and processed near Aspers in Adams County by Summit Industries. Schist is used as a mineral filler and as an ingredient in insecticides, joint cement, and enamel coating.

Some prospecting and core-drilling for talc were performed near Jenkins Corners, Lancaster County, along a serpentinite contact with schist. The prospecting was done by Aguda Mining Corp. of Pittsburgh.

Tripoli (Rottenstone).—Crude tripoli, mined and processed by two companies in Lycoming County, was 15 percent less in quantity and 27 percent less in value compared with 1969 statistics. The material was prepared for use as a filler by one plant near Muncy. The other company near Oriole employed drying, crushing, and roller-mill grinding to produce abrasives and fillers. Pennsylvania ranked fourth among U.S. producers.

Vermiculite (Exfoliated).—Hyzer & Lewellen in Berks County and the W. R. Grace & Co., Zonolite Division, in Lawrence County exfoliated vermiculite shipped into the State. The major use was for building insulation and cryogenic insulation. The product was also used in plaster aggregate, concrete aggregate, soil conditioning, horticulture, fire-resistant cementitious compounds, and carriers and conditioners for agricultural chemicals and fertilizers.

METALS

Aluminum.—A $3 million modernization program was completed at the Cressona Works of the Aluminum Co. of America. Included was a 3,000-ton extrusion press that helped the company expand its output of building products.

The R. D. Werner Co., Inc., announced plans for a 40,000-square-foot plant to produce aluminum extrusions at Greenville, Mercer County.

Beryllium.—A $7.5 million expansion program requiring an additional 25,000 square feet and 25 employees was completed at the Hazleton plant of Kawecki Berylco Industries, Inc. The doubling of melt capacity was achieved by the installation of induction furnaces for beryllium-copper, beryllium-aluminum, beryllium-nickel, and other alloys. A new rolling mill capable of producing beryllium and its alloys in sheets with 180-inch lengths and 48-inch widths was installed as was a new isostatic press capable of forming complex shapes directly from beryllium powder.

Cerium.—A new solvent-extraction process for producing 99.9-percent cerium oxide was started at the York chemical plant of Molybdenum Corp. of America using cerium concentrate feedstock from the corporation's bastnäsite (cerium fluocarbonate) mining and separation complex at Mountain Pass, Calif. New applications predicted for using cerium's unique catalytic and reactive properties include the following: The improvement of properties of glasses, enamels, paper, textiles, zirconia refractories, and light-fast pigments; for the catalytic oxidation of hydrocarbons in exhaust-gas purification and self-cleaning ovens; and to provide better yield strength and elongation of ductile iron while combating tramp elements.

Cobalt.—The quantity and value of cobalt produced was about 31 percent less than in 1969.

Magnetic iron ore mined by the Bethlehem Steel Corp. in Berks and Lebanon Counties was the only U.S. domestic source of cobalt. The Lebanon County ore contained about two-thirds of the recoverable cobalt. Cobaltic pyrite concentrates recovered by the flotation of magnetic separator tailings were shipped to Sparrows Point, Md., for use in sulfuric acid manufacture. There the calcine from the acid plant was leached to recover cobalt and copper as a liquid sulfate concentrate, containing no gold or silver, that was processed into cobalt metal, oxide and hydrate, and electrolytic copper or copper chemicals by the Pyrites Co., Inc., Wilmington, Del.

In April, solvent extraction was introduced at this plant, marking a transition from the previous obsolete techniques to modern recovery methods. Cobalt production in the United States in 1970 was esti-

[19] The Pennsylvania State Geological Survey. Pennsylvania Geology. V. 2, No. 1, February 1971, p. 14.

mated as 220 short tons while consumption was forecast as 8,417 short tons.[20]

Copper, Gold, and Silver.—Compared with 1969 figure, the respective production of these metals was 25, 25, and 30 percent less and their respective value was 9, 35, and 27 percent less.

These metals were contained in a chalcopyrite concentrate produced during the processing of iron ore from the Cornwall mine of the Bethlehem Steel Corp. The chalcopyrite concentrate contained about 28 percent copper and was shipped to a western smelter.

Plans were announced in March by Ag-Met., Inc., for a new $1 million secondary silver refinery, at Lofty, with a capacity of 60,000 ounces of silver per week and smaller quantitites of platinum and gold.

The new $10 million world headquarters of The Franklin Mint was dedicated at Franklin Center. This facility, the world's largest private mint, produced commemorative medals valued at $45.8 million for collectors, and coins for the Bahamas, Jamaica, Panama, and Tunisia.

Iron Ore.—The Bethlehem Steel Corp. produced magnetic iron ores at the Grace underground mine in Berks County and at the Cornwall underground mine and a small open pit operation in Lebanon County. Explosives consumed at these three mines totaled 1.84 million pounds comprising 550,000 pounds of dynamites and 1.29 million pounds of bagged and bulk ammonium nitrate. Both underground mines used the block caving mining method. All operations of the Cornwall Division will cease at the end of 1972. The crude ores were beneficiated and processed into pellets in two plants nearby. The pellets were shipped to the Corporation's iron and steel works.

Pellet shipments were about 9 percent less in quantity and about 5 percent less in value than those of 1969.

Iron and Steel.—Of the 90 iron and steel establishments in the State, 14 operated by eight companies were classed as producers of raw iron and steel. Raw steel production was 30,031,000 short tons compared with 32,791,000 short tons in 1969. Pig iron and hot metal production totaled 20.8 million tons, 6.7 percent less than in 1969. Of the pig iron and hot metal produced, 94.2 percent was basic, 3.8 percent was Bessemer, and 2.0 percent was malleable and direct casting. The ferroalloys production was 395,000 tons compared with 448,000 tons in 1969, according to the American Iron and Steel Institute.

Of the 22.2 million tons of ores and concentrates consumed (excluding agglomerates), 53.5 percent went to agglomerating plants, 43.0 percent to blast furnaces, and 3.5 percent to steel furnaces. Receipts of iron ore, including 84,447 tons of manganiferous ores, totaled 23.9 million tons, 36.4 percent from U.S. sources and 63.6 percent from foreign countries. The 10.0-million-ton iron ore stock on January 1 decreased to 9.4 million tons at yearend, while on the same date consumers had 1,625,000 tons of scrap and 315,000 tons of pig iron in stock.

Agglomerating plants consumed 11.9 million tons of iron ores, 988,611 tons of limestone, 1,113,924 tons of dolomite, 154,676 tons of other fluxes, 928,453 tons of mill cinder and roll scale, 887,886 tons of raw flue dust, 194,265 tons of steel furnace slags, 706,689 tons of coke breeze, and 236,139 tons of Pennsylvania anthracite.

Although there were 41 active blast furnaces on January 1, there were only 33 at yearend. Idle blast furnaces totaled 15 on January 1 and 22 on December 31. Blast furnaces consumed 9.6 million tons of iron ores, 3.9 million tons of regular U.S. sinter, 10.9 million tons of semi- and self-fluxing sinter, 5.1 million tons of regular iron ore pellets, 885,331 tons of limestone, 1,396,989 tons of dolomite, 286,602 tons of other fluxes, 368,038 tons of mill cinder and roll scale, 1,345,313 tons of steel furnace slags, 13,132,085 tons of breeze-free coke, 23,396 tons of coke breeze, 27,042 tons of pig iron, 879,159 tons of home and purchased scrap, 151,467 tons of slag scrap, and 246 tons of alloys and miscellaneous solids. Blast furnaces produced 174,093 tons of scrap, 6,605,674 tons of slag, and recovered 754,301 tons of flue dust. Blast furnace coke consumption averaged 1,263 pounds for each short ton of hot metal produced.

Open-hearth, basic oxygen furnaces, and Bessemer steel furnaces consumed 789,432 tons of iron ores, 11,762 tons of semi- and self-fluxing sinter, 50,695 tons of regular iron ore pellets, 653,672 tons of limestone, 429,347 tons of dolomite, 679,603 tons of other fluxes, 30,711 tons of mill cinder and

[20] Pearce, R. F. Cobalt. Eng. and Min. J., v. 172, No. 3, March 1971, pp. 113–114.

roll scale, 1,420 tons of Pennsylvania anthracite, 19.7 million tons of pig iron and hot metal, 10.0 million tons of home and purchased scrap, 101,598 tons of slag scrap, and 85,839 tons of alloys and miscellaneous solids.

Supplemental fuels consumed in blast furnaces by injection through tuyeres only included 44,695 million cubic feet of natural gas, 3,899 million cubic feet of coke oven gas, 28,952 tons of bituminous coal, 37,959,217 gallons of tar and pitch, and 155,427,484 gallons of other liquid fuels.

The No. 1 blast furnace of the United States Steel Corp. at Duquesne started producing ferromanganese to meet a current shortage.

The United States Steel Corp. announced plans for a 5,600-square-foot facility employing 50 persons for manufacturing silicon steel at Vandergrift in Westmoreland County.

The Bethlehem Steel Corp. at Steelton completed its electric furnace shop by the addition of a third electric furnace rated at an annual capacity of 315,000-tons.

In April, the Bethlehem Steel Corp. announced plans to construct a new 50,000-ton-per-year capacity mineral-wool plant near its Northampton coke plant for converting blast-furnace slag into mineral wool by a heating-and-spinning process. This wool plant, to be operated by the stone and slag division of Bethlehem's mining department, will be a 30,000-square-foot facility employing 30 to 40 persons.

The Allegheny Ludlum Steel Division placed in operation two four-pit batteries of ingot-heating furnaces at Brackenridge and a continuous bright annealing line at West Leechburg.

The largest and most versatile luminous wall heat-treating furnace in the forging industry was installed by the Edgewater Corp. at Oakmont. The 125-ton capacity car-type furnace can operate at temperatures ranging from 500° to 1,950° F. The 36-foot-long furnace, rated at a 12-million-Btu-per-hour heat-input capacity, can be heated quickly and cooled within minutes instead of hours as for conventional equipment. Scale formation on work pieces is minimized by atmosphere control.

At the Butler Works of the Armco Steel Corp., phasing out of open hearths was completed. Steelmaking, by this largest U.S. producer of electrical (silicon) steels, then depended solely on electric furnaces equipped with wet-scrubber dust collectors. The Butler Works was the first in the State to attain continuous casting on a commercial scale when a 20,000-ton-per-month, $16 million, 2-strand, slab caster was put on a production basis in April. The installation of two special furnaces was in progress, one for curing various coatings and the other for the thermal flattening of silicon steel.

Platinum.—A new platinum-melting, rolling, and drawing plant was put into operation by Matthey Bishop, Inc., at West Whiteland. Products included platinum sheet, wire and tubing, oxidation gauze, melting pots for laser materials, laboratory ware, fume-abatement equipment, and hydrogen purifiers.

Powdered Metals.—Announcements were made by five powdered metal companies for new facilities totaling more than 46,400 square feet and requiring more than 76 employees. Three of the facilities were for Domtar Chemicals, Inc., and Exotic Metals, Inc., Ridgway; and Carbon City Products, Inc., St. Marys in Elk County. The other two facilities were for the St. Marys Carbon Co. Galeton, Potter County, and Dimatics, Inc., Tarentum, Allegheny County.

Uranium.—The Metropolitan Edison Co., at Reading, contracted to purchase from the Kerr-McGee Corp. 126,500 kilograms of uranium hexafluoride enriched to about 2.6 percent U-235 and valued at $16.7 million. This material, after processing into pellets and fabrication into nuclear fuel elements, will fuel the Three Mile Island Unit No. 1 power reactor under construction near Harrisburg. The hexafluoride will be produced by Kerr-McGee at its new Sequoyah facility in Oklahoma by the conversion of about 1 million pounds of uranium concentrate from its mining and milling operations near Grants, N. Mex.

Zinc.—Zinc ore, principally sphalerite, was mined and concentrated at Friedensville in Lehigh County. Based on the quantity of recoverable zinc metal, the mine output of zinc was 10.6 percent less and the value of production was 6.2 percent less than in 1969. The zinc concen-

trates were shipped to the New Jersey Zinc Co.'s vertical-retort smelter at Palmerton, where anthracite silt was used in the sintering operation. The smelter's products included rolled zinc, slab zinc, zinc die casting alloys, dry battery shells, zinc oxide, spiegeleisen, cadmium, and sulfuric acid.

Table 13.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives:			
Nonmetallic: Satellite Alloy Corp.	9800 McKnight Rd. Pittsburgh, Pa. 15237	Plant	Allegheny.
Metallic:			
Abrasive Metals Co	26th & B. & O. RR Pittsburgh, Pa. 15222	do	Do.
Durasteel Abrasive Co.	2601 Smallman St. Pittsburgh, Pa. 15222	do	Westmoreland.
Industeel Corp	37th & A. V. RR Pittsburgh, Pa. 15222	do	Allegheny.
Pangborn Div., the Carborundum Co.	P.O. Box 380 Hagerstown, Md. 21740	do	Butler
Cement:			
Allentown Portland Cement Co., Div. National Gypsum Co.[1]	7th St. at Thruway Allentown, Pa. 18101	do	Berks.
Allentown Portland Cement Co., Div. National Gypsum Co.	do	do	Montgomery.
Bessemer Cement Co., subsidiary of Louisville Cement Co.	510 Hanna Bldg. Cleveland, Ohio 44115	do	Lawrence.
Coplay Cement Manufacturing Co.[1]	North 2nd St. Coplay, Pa. 18037	do	Lehigh.
Do	Easton Rd. Coplay, Pa. 18037	do	Northampton.
Dragon Cement Co., div. of Martin-Marietta Corp.[1]	5A Joyce Kilmer Ave. New Brunswick, N.J. 08903	do	Do.
Green Bag Cement Co., div. of Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	do	Allegheny.
Hercules Cement Co., div. of American Cement Corp.[1]	555 City Line Ave. Bala-Cynwyd, Pa. 19004	do	Northampton.
Keystone Portland Cement Co.[1]	2200 Hamilton St. Allentown, Pa. 18105	do	Do.
Lone Star Cement Corp.[1]	P.O. Box 6237 West End Br. Richmond, Va. 23230	do	Do.
Medusa Portland Cement Co.[2]	P.O. Box 5668 Cleveland, Ohio 44101	do	Lawrence.
Medusa Portland Cement Co.[3 4]	do	do	York.
National Portland Cement Co.[1]	1023 West St. George Ave. Linden, N.J. 07036		Northampton.
Penn-Dixie Cement Corp.[5]	P.O. Box 152 Nazareth, Pa. 18064	do	Butler.
Penn-Dixie Cement Corp.[1]	do	do	Northampton.
Universal Atlas Cement Div., U.S. Steel Corp.	600 Grant St. U.S. Steel Bldg. Pittsburgh, Pa. 15230	do	Allegheny.
Universal Atlas Cement Div., U.S. Steel Corp.[1]	do	do	Northampton.
The Whitehall Cement Manufacturing Co.[1]	123 South Broad St. Philadelphia, Pa. 19109	do	Lehigh.
Clay and shale:			
Fire:			
Drexel Refractories Div., Drexel Dynamics Corp.	P.O. Box 50 Kittanning, Pa. 16201	Underground	Armstrong.
Freeport Brick Co	Drawer F Freeport, Pa. 16229	do	Do.
Freeport Brick Co., Kittanning Brick Div.	R.D. 1 Adrian, Pa. 16210	do	Do.
Hanley Co	28 Kennedy St. Bradford, Pa. 16701	do	Jefferson.
Harbison Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	do	Armstrong.
Do	do	Pit	Cambria, Centre, Clearfield, Fayette, Somerset.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clay and shale—Continued			
Fire—Continued			
Ralph A. Veon, Inc	Darlington, Pa. 16115	Pit	Lawrence.
Kaolin: The Philadelphia Clay Co.	236 West North St. Carlisle, Pa. 17013	Pit	Cumberland.
Common clay and shale:			
Alwine Brick Co., subsidiary of Glen-Gery Corp.	New Oxford, Pa. 17350	Pit	Adams.
Bylite Corp	P.O.Box 1628, North End Station Wilkes-Barre, Pa. 18705	Pit	Luzerne.
Fenati Brick Co., Inc	New Castle, Pa. 16101	Pit	Lawrence.
Glen-Gery Corp	227 North 5th St. Reading, Pa. 19601	Pit	Berks, Dauphin, Lancaster, Northumberland, York.
Hanley Co	28 Kennedy St. Bradford, Pa. 16701	Pit	McKean.
McAvoy Vitrified Brick Co.	Phoenixville, Pa. 19460	Pit	Chester.
McQuiston Coal Co. [6]	109 East Moody Ave. New Castle, Pa. 16101	Pit	Lawrence.
Milliken Brick Co., Inc.	2100 Montier St. Pittsburgh, Pa. 15221	Pit	Allegheny.
The Robinson Clay Product Co.	65 West State St. Akron, Ohio 44309	Pit	Montgomery.
Coal:			
Anthracite:			
Blue Coal Corp [4]	101 South Main St. Ashley, Pa. 18706	Underground	Luzerne.
Blue Coal Corp [7]	do	Culm bank	Do.
Blue Coal Corp [8]	do	Strip	Do.
Carbondale Coal Co., Inc.[4]	78 Cottage St. Carbondale, Pa. 18407	do	Lackawanna.
Gangloff Brothers [4]	New Ringgold, Pa. 17960	Culm bank	Northumberland.
Glen-Nan Coal Co., Inc.	St. Mary's and River Road Wilkes-Barre, Pa. 18702	Underground	Luzerne.
Greenwood Stripping Corp.	1 Venice St. Nesquehoning, Pa. 18240	Strip	Carbon, Schuylkill.
Jeddo-Highland Coal Co.[8]	800 Exeter Ave. West Pittston, Pa. 18643	do	Luzerne.
Jeddo-Highland Coal Co.[4]	do	Culm bank	Do.
Kerris & Helfrick, Inc	Lehigh & Popular St. Mount Carmel, Pa. 18751	Strip	Columbia, Northumberland, Schuylkill.
Lehigh Valley Anthracite, Inc.	800 Exeter Ave. West Pittston, Pa. 18643	Culm bank	Carbon, Schuylkill, Luzerne.
Do	do	Strip	Columbia, Luzerne, Schuylkill.
Pennsylvania Power & Light Co.	901 Hamilton St. Allentown, Pa. 18101	Dredge	Lancaster.
Ken Pollock, Inc [4]	Route 11 Hunlock Creek, Pa. 18621	Culm bank	Luzerne.
Reading Anthracite Co.	200 Mahantongo St. Pottsville, Pa. 17901	do	Northumberland, Schuylkill.
Do	do	Strip	Do.
Bituminous:			
Barnes & Tucker Co	357 Lancaster Ave. Haverford, Pa. 19041	Underground	Cambria, Indiana.
Bethlehem Mines Corp.	701 East 3d St. Bethlehem, Pa. 18016	do	Cambria, Washington.
Buckeye Coal Co	P.O. Box 900 Youngstown, Ohio 44501	do	Greene.
Gateway Coal Co. for J & L.	Box 608 California, Pa. 15419	do	Do.
Harmar Coal Co [4]	Box 500 Library, Pa. 15129	do	Allegheny.
Jones & Laughlin Steel Corp.	Box 608 California, Pa. 15419	do	Greene.
Mathies Coal Co	Box 500 Library, Pa. 15129	do	Washington.
Pittsburgh Coal Co [4]	do	do	Do.
United States Steel Corp.	525 Wm. Penn Pl. Pittsburgh, Pa. 15219	do	Greene, Washington.
Graphite (synthetic):			
Airco Speer Carbon Products, div. of Air Reduction Co., Inc.	Theresia St. St. Marys, Pa. 15857	Plant	Elk.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Graphite (synthetic)—Continued			
Chas. Pfizer & Co., Inc., MPM Division.	235 East 42d St. New York, N.Y. 10017	Plant	Northampton.
Stackpole Carbon Co	St. Marys, Pa. 15857	do	Elk.
Gypsum (calcined): United States Gypsum Co.[9]	101 South Wacker Dr. Chicago, Ill. 60606	do	Philadelphia.
Iron ore:			
Bethlehem Mines Corp [10]	701 East 3d St. Bethlehem, Pa. 18016	Underground	Berks.
Bethlehem Mines Corp [11]	do	do	Lebanon.
Iron oxide pigments:			
Crude:			
Allegheny Ludlum Steel Corp.	2000 Oliver Bldg. Pittsburgh, Pa. 15222	Plant	Allegheny.
Lanzendorfer Minerals Co.	Twin Rocks, Pa. 15960	Pit	Cambria
Finished:			
Minerals, Pigments, & Metals Div., Chas. Pfizer & Co., Inc.	640 North 13th St. Easton, Pa. 18042	Plant	Northampton.
The Prince Manufacturing Co.	Bowmanstown, Pa. 18030	do	Carbon.
Reichard-Coulston, Inc.	15 East 26th St. New York, N.Y. 10010	do	Northampton.
Lime:			
The J. E. Baker Co [1]	P.O. Box 1189 York, Pa. 17405	do	York.
Mercer Lime & Stone Co	1640 Oliver Bldg. Pittsburgh, Pa. 15222	do	Butler.
National Gypsum Co [1]	325 Delaware Ave. Buffalo, N.Y. 14202	do	Centre.
Standard Lime & Refrac. Co., div. Martin-Marietta Corp.[1]	2000 First National Bank Bldg. Baltimore, Md. 21203	do	Do.
Warner Company [1]	1721 Arch St. Philadelphia, Pa. 19103	do	Centre, Chester.
Mica (crude): Micalith Mining Co., Inc.	P.O. Box 1671 Phoenix, Ariz. 85001	Pit	York.
Peat:			
Benton Peat	Benton, Pa. 17814	Bog	Columbia.
Blue Ridge Industries, Inc	Box 128, R.D. 2 White Haven, Pa. 18661	Bog	Luzerne.
D. M. Boyd Co	226 Francis St. New Wilmington, Pa. 16142	Bog	Lawrence.
Corry Peat Products Co	515 West Columbus Ave. Corry, Pa. 16407	Bog	Erie.
International Peat, Inc	R.D. 1 White Haven, Pa. 18661	Bog	Luzerne.
Lake Benton Peat Moss	1418 North Main St. Scranton, Pa. 18508	Bog	Lackawanna.
Pennsylvania Peat Moss, Inc.	21st & Laurel Sts. Hazleton, Pa. 18201	Bog	Luzerne, Monroe.
Stillers Blue Ridge Peat Co.	R.D. White Haven, Pa. 18661	Bog	Luzerne.
Wayne Peat Humus Co., Inc.	P.O. Box 315 Gouldsboro, Pa. 18424	Bog	Wayne.
Welker's Greenhouse, Inc.	New Castle, Pa. 16101	Bog	Lawrence.
Perlite (expanded):			
Armstrong Cork Co	Lancaster, Pa. 17603	Plant	Lancaster.
The Celotex Corp	1500 North Dale Mabry Tampa, Fla. 33607	do	Luzerne.
Insul-Fil Manufacturing Co.	Box 325 Primos, Pa. 19018	do	Delaware.
Pennsylvania Perlite Corp.	P.O. Box 2002 Lehigh Valley, Pa. 18001	do	Lehigh, York.
Perlite Manufacturing Co	P.O. Box 478 Carnegie, Pa. 15106	do	Allegheny.
Petroleum refineries:			
Atlantic Richfield Co	260 South Broad St. Philadelphia, Pa. 19102	do	Philadelphia.
BP Oil Corp	600 Fifth Ave. New York, N.Y. 10001	do	Delaware.
Gulf Oil Corp	P.O. Box 7408 Philadelphia, Pa. 19101	do	Erie.
Kendall Refining Co., div. of Witco Chemical Co.	Bradford, Pa. 16701	do	McKean.
Pennsylvania Refining Co.	Karns City, Pa. 16041	do	Butler.
Pennzoil United, Inc	Oil City, Pa. 16301	do	Venango.
Quaker State Oil Refining Corp.	Farmers Valley, Pa. 16749	do	McKean, Venango.
Sun Oil Company	1608 Walnut St. Philadelphia, Pa. 19101	do	Do.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum refineries—Continued			
United Refining Co	Warren, Pa. 16365	Plant	Warren.
Valvoline Oil Co., div. of Ashland Oil and Refining Co.	Freedom, Pa. 15042	do	Beaver.
Wolf's Head Oil Refining Co., Inc.	Reno, Pa. 16343	do	Venango.
Sand and gravel:			
Davison Sand & Gravel Co.	34th Ave. & 4th St. New Kensington, Pa. 15068	Dredge	Westmoreland.
East Falls Sand & Gravel	R.D. 1 Falls, Pa. 18615	Pit	Wyoming.
Erie Sand Steamship Co	Erie, Pa. 16500	Dredge	Erie.
Glacial Sand & Gravel Co.	P.O. Box 10 Kittanning, Pa. 16201	Pit	Armstrong.
Hunlock Sand & Gravel Co.	Box 275–A R.D. 1 Hunlock Creek, Pa. 18621	Pit & Plant	Luzerne.
Lycoming Silica Sand Co	401 Broad St., Box 159 Montoursville, Pa. 17754	Pit	Lycoming.
Mahoning Valley Sand Co.	Box 1236 New Castle, Pa. 16102	Pit & Plant	Lawrence.
Manorville Sand Co	Box 251 Manorville, Pa. 16238	Pit	Armstrong.
Mount Cydonia Sand Co., Inc.	R.D. 1 Fayetteville, Pa. 17222	Pit	Franklin.
Pennsylvania Glass Sand Corp.	Berkeley Springs, W.Va. 25411	Pit	Huntingdon, Mifflin.
Pennsy Supply, Inc	1001 Paxton St. Harrisburg, Pa. 17104	Pit	Perry.
Seidle Sand & Gravel, Inc.	R.D. 4 Mercer, Pa. 16137	Pit	Mercer.
State Aggregates, Inc	635 Lucknow Lane Harrisburg, Pa. 17110	Pit	Bradford.
Warner Company	1721 Arch St. Philadelphia, Pa. 19103	Pit	Bucks.
Wyoming Sand & Stone Co.	Falls, Pa. 18615	Pit	Wyoming.
Smelters:			
The New Jersey Zinc Co	Palmerton, Pa. 18071	Plant	Carbon.
St. Joe Minerals Corp	Josephtown, Pa. 15061	do	Beaver.
Stone:			
Limestone and dolomite—crushed:			
Appalachian Stone Div., Martin-Marietta Corp.	Box 120 Mercersburg, Pa. 17236	Quarry	Centre, Chester, Fayette, Franklin.
Bethlehem Mines Corp.[12]	701 East 3d St. Bethlehem, Pa. 18016	do	Adams.
Bethlehem Mines Corp.	do	do	Dauphin, Mifflin, Montgomery, Northampton.
Bradford Hills Quarries, Inc.	Box 231 Easton, Pa. 18042	do	Chester, Lancaster, Montgomery, Perry.
G. & W. H. Corson, Inc.[12]	Plymouth Meeting, Pa. 19462	do	Montgomery.
Eureka Stone Quarry, Inc.	Lower State & Pickertown Rds. Eureka, Pa. 18914	do	Bucks.
Eastern Industries Inc.	Box 188 Wescosville, Pa. 18090	do	Berks, Lehigh.
Lycoming Silica Sand Co.	P.O. Box 159 Montoursville, Pa. 17754	do	Clinton, Columbia, Lycoming, Montour.
National Gypsum Co.	325 Delaware Ave. Buffalo, N.Y. 14202	do	York, Centre.
New Enterprise Stone & Lime.	New Enterprise, Pa. 16664	do	Bedford, Blair, Franklin, Huntingdon.
United States Steel Corp.	Hillsville, Pa. 16132	do	Lawrence.
Miscellaneous—crushed & broken:			
Better Materials Corp.	Route 232 & Swamp Rd. Penns Park, Pa. 18943	do	Bucks.
Gill Quarries, Inc	P.O. Box 187 Fairview Village, Pa. 19434	do	Bucks, Montgomery.
M & M Stone Co	Harleysville, Pa. 19438	do	Do.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Miscellaneous—dimension:			
Burdo & Burdo	29 Washington Ave. Belmont Heights Philadelphia, Pa. 19100	Quarry	Do.
F. Cantono & Sons	454 Germantown Pike Lafayette Hill, Pa. 19444	do	Delaware.
Di Bonaventura Quarries, Inc.	4989 West Thompson St. Philadelphia, Pa. 19131	do	Do.
Oystershell—crushed: Reading Poultry Food Co.	Orrton & Noble Sts. Reading, Pa. 19600	Plant	Berks.
Sandstone and quartzite—crushed:			
American Asphalt Paving Co.	Box 95, R.D. 5 Shavertown, Pa. 18700	Quarry	Luzerne.
Bear Gap Stone Inc	R.D. 1 Elysburg, Pa. 17824	do	Northumberland.
Coolbaugh Sand & Stone, Inc.	32 Railroad Ave. Scranton, Pa. 18505	do	Luzerne.
Detwilers Industries, Inc., subsidiary of New Enterprise Stone & Lime Co., Inc.	New Enterprise, Pa. 16664	do	Bedford, Somerset.
Eidemiller Enterprises, Inc.	Greensburg, Pa. 15601	do	Westmoreland.
Faylor Lime & Stone Co.	Winfield, Pa. 17889	do	Dauphin, Northampton.
Keeler Supply Co., Inc.	Box 12 Clifford, Pa. 18413	do	Susquehanna.
Latrobe Construction Co.	P.O. Box 150 Latrobe, Pa. 15650	Underground	Westmoreland.
No. 1 Contracting Corp. of Delaware.	Box 460 Pittston, Pa. 18640	Quarry	Northampton, Schuylkill.
Summit Quarries, Div. of J. Robert Bazley, Inc.	P.O. Box 298 Pottsville, Pa. 17901	do	Schuylkill.
Sandstone and quartzite—dimension:			
Caln Building Stone Corp.	R.D. 1 Zion Grove, Pa. 17985	do	Chester.
Delaware Quarries	Lumberville, Pa. 18933	do	Bucks.
Firestone Products Co., Inc.	300 Willow Grove Ave. Glenside, Pa. 19038	do	Montgomery.
Media Quarry Co	131 East 2d St. Media, Pa. 19063	do	Delaware.
Paul Tompkins Estate	Hancock, N.Y. 13783	do	Wayne.
Valley Forge Building Stone.	P.O. Box 195 Morgantown, Pa. 19543	do	Chester.
Slate—crushed:			
GAF Corp., Building, Industrial & Floor Products Div.	140 West 51st St. New York, N.Y. 10020	do	York.
Pennsylvania Lightweight Aggregate, Inc.	Bangor, Pa. 18013	do	Northampton.
Slate—dimension:			
Capitol Slate Co., Inc.	P.O. Box 281 East Bangor, Pa. 18040	do	Do.
Anthony Dally & Sons, Inc.	Robinson Ave. Pen Argyl, Pa. 18072	do	Do.
Doney Slate Co	Pen Argyl, Pa. 18072	do	Do.
Emerald Slate Corp	Alpha Road Wind Gap, Pa. 18091	do	Do.
North Bangor Slate Co.	Bangor, Pa. 18013	do	Do.
Penn Big Bed Slate Co., Inc.	446 Main St. Slatington, Pa. 18080	do	Lehigh.
Stephens-Jackson Co	Main St. & Schanck Ave. Pen Argyl, Pa. 18072	do	Northampton.
D. Stoddard & Sons, Inc.	Bangor, Pa. 18013	do	Do.
Traprock (basalt)—crushed and broken:			
Bucks County Crushed Stone, Inc.	Ottsville, Pa. 18942	do	Bucks.
V. Di Francesco & Sons.	17 Mifflin Ave. Havertown, Pa. 19083	do	Chester.
Do	do	do	Delaware.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Traprock (basalt)—crushed and broken—Continued			
GAF Corp., Building, Industrial & Floor Products Div.	140 West 51st St. New York, N.Y. 10020	Quarry	Adams.
The General Crushed Stone Co.	712 Drake Bldg. Easton, Pa. 18042	do	Bucks, Delaware.
Vernon B. Horn	R.D. Chalfont, Pa. 18914	do	Bucks.
Kibblehouse Quarries, Inc.	Perkiomenville, Pa. 18074	do	Montgomery.
Montgomery Stone Co., Inc.[13]	Montgomeryville, Pa. 18936	do	Do.
Pottstown Trap Rock Quarries, Inc.	R.D. 1 Douglasville, Pa. 19518	do	Berks, Montgomery.
Tohickon Quarry Co	Quakertown, Pa. 18951	do	Bucks.
Warner Company	1721 Arch St. Philadelphia, Pa. 19103	do	Berks.
Traprock (basalt)—dimension: Coopersburg Granite Co.	Coopersburg, Pa. 18036	do	Bucks.
Granite—crushed: Mignatti Constr. Co., Inc.	2310 Terwood Ave. Bethayres, Pa. 19006	do	Montgomery.
Granite—dimension:			
French Creek Granite Co.	St. Peters, Pa. 19470	do	Chester.
Carl Galantino, Inc	42 Hirst Ave. East Lansdowne, Pa. 19050	do	Delaware.
Sulfur:			
Atlantic Richfield Co	3144 Passyunk Ave. Philadelphia, Pa. 19145	Plant	Philadelphia.
Gulf Oil Corp	P.O. Box 7408 Philadelphia, Pa. 19101	do	Do.
BP Oil Corp., subsidiary of British Petroleum Corp. Ltd.	P.O. Box 428 Marcus Hook, Pa. 19061	do	Delaware.
Sun Oil Co	1608 Walnut St. Philadelphia, Pa. 19103	do	Do.
Talc (sericite-schist): Summit Industries, Inc.	Drawer C Aspers, Pa. 17304	Pit	Adams.
Tripoli (rottenstone):			
Keystone Filler & Manufacturing Co.	Muncy, Pa. 17756	Pit	Lycoming.
Penn Paint & Filler Co	Antes Fort, Pa. 17720	Pit	Do.
Vermiculite (exfoliated):			
Hyzer & Lewellen	P.O. Box 155 Southampton, Pa. 18966	Plant	Bucks.
W. R. Grace & Company, Zonolite Div.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Lawrence.

[1] Also limestone.
[2] Also limestone and shale.
[3] Also limestone and clay.
[4] 2 operations.
[5] Also limestone and sand and gravel.
[6] Also fire clay.
[7] 3 operations.
[8] 4 operations.
[9] Also expanded perlite.
[10] Also byproduct cobalt and pyrites.
[11] Also byproduct gold, silver, copper, cobalt, and pyrites.
[12] Also lime.
[13] Also dimension.